

**PROJECTION MODELS FOR SELECTED REQUIREMENTS IN THE
IMPLEMENTATION OF COMPETENCY BASED CURRICULUM IN SENIOR
SECONDARY SCHOOLS IN KENYA.**

Dorothy Muhenge Sagwa

**A Research Thesis submitted in partial fulfilment of the requirements of
the Degree of Doctor of Philosophy in Educational Planning and
Management of Masinde Muliro University of Science and Technology**

August, 2025.

DECLARATION

I declare that this thesis is my original work prepared with no other than the indicated sources and support and has not been presented elsewhere for a degree or any other award.

Signed:

Date:

Dorothy Muhenge Sagwa

Reg. No: EPM/H/01-57279/2016

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The undersigned certify that they have read and hereby recommend acceptance of Masinde Muliro University of Science and Technology a thesis entitled “**Projection Models for Selected Requirements in the Implementation of Competency Based Curriculum in Senior Secondary Schools in Kenya.**”

Signed:.....

Date:

Prof. S. O. Odebero PhD, FIEEP,

Department of Educational Planning and Management

Masinde Muliro University of Science and Technology

Signed:

Date:

Dr. Jason Nganyi PhD.

Department of Educational Planning and Management

Masinde Muliro University of Science and Technology

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DEDICATION

I wish to humbly dedicate this work to the Almighty God for enabling me to accomplish this task. To my beloved mum, the late, Judith Alivitsa, for her love, support and encouraging words before her demise.

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I am grateful to God for enabling me to overcome all of the challenges. The achievement of this work was made probable with the sanctifications of the Almighty God. For the health, the energy and the wisdom to undertake this task, Glory be to Him. I have been under Your guidance on a daily basis. You are the Individual who enabled me to complete my education. To ensure my future, I will continue to rely on You.

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ABSTRACT

In a major departure from the 8-4-4 system, the new education system of 2-6-3-3-3 was launched in 2017 and named Competency Based Curriculum (CBC). The purpose of this study was to come up with projection models for the Senior Secondary School enrolment in 2026 and for selected requirements for the implementation of CBC in Senior Secondary Schools in Kenya in 2026. Enrolment projections are critical for the government and planners to allocate education - related resources and ensure necessary school infrastructure and teachers are provided. The selected requirements included teachers, selected infrastructure, textbooks and Subsidised Secondary Education Capitation. The objectives of the study were to project the enrolment progression trends of Grade 1 2017 CBC cohort into Senior Secondary Schools in 2026, to model projections of teacher requirements for the implementation of the CBC in Senior Secondary Schools, to model projections of infrastructure requirements for the implementation of the CBC in Senior Secondary Schools, to model projections of textbook requirements for the implementation of the CBC in Senior Secondary Schools and to model projections of Subsidised Secondary Education capitation requirements for the implementation of CBC in Senior Secondary Schools in Kenya in 2026. The study was guided by the rational comprehensive (Synoptic) planning theory which allows for the evaluation that consists of procedures such as cost benefit analysis, systems analysis, and forecasting (projection) research. The study adopted a predictive research design. All the primary and secondary schools in Vihiga County were the target population for the study. Collection of data was done by means of questionnaires, document analysis and direct observation. For teacher projections, the Ministry of Education (MoE) Pupil-Teacher Ratio of 45:1 was used. Textbooks/ pupil ratio of 1:1 was used to determine textbooks required for Senior Secondary School implementation according to the MoE policy. Classrooms projection was arrived at through total projected enrolment for the year divided by class size based on the MoE policy and free secondary capitation through total projected enrolment multiplied by the MoE capitation per student. The study followed Thonstad's Grade Transition Model for projecting the CBC enrolment trends of the 2017 Grade one cohort to Junior and eventually Senior School. The study analyzed enrollment statistics from the years 2017 to 2021. The results of this study demonstrated a steady rise in CBC enrollment up until the year 2026. The estimated enrollment in senior high school is expected to rise from 24,361 in 2026 to 26,198 in 2028 in Vihiga County. The results suggest a rise in enrolment which further results in a corresponding increase in the need for teachers, physical infrastructure, and the average size of schools. The analysis determined that there will be a deficit of Teachers and anticipated insufficiency of necessary facilities as a result of the expected rise in student enrollment at the Senior Secondary level by 2026. The study therefore recommended the need to expand the physical infrastructure, the need for Teachers Service Commission (TSC) to roll out a plan to employ more teachers by 2028. With the findings of this study, the MOE, and TSC may be guided to consider adequate employment of teachers who are CBC compliant and the need for adequate textbooks supply in time for use during instruction. With the enrolment projections at Senior Secondary Schools in 2026, budgetary allocations will be much easier by the stakeholders. The results of this study would also provide valuable information to policy makers, such as the TSC and Ministry of Education, to develop effective policy reforms that would improve the delivery of high-quality education in Vihiga County.

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ABBREVIATIONS AND ACRONYMS

BECF	- Basic Education Curriculum Reform Framework
CBAM	- Concerns Based Approach Model.
CBC	- Competency-Based Curriculum
CBME	- Competency Based Medical Education
CSOs	- Curriculum Support Officers
EI	- Education International
IMF	- International Monetary Fund
KIE	- Kenya Institute of Education
KNA	- Kenya News Agency
KNBS	- Kenya National Bureau of Statistics
KNEC	- Kenya National Examinations Council
MOE	- Ministry of education
NACOSTI	- National Commission for Science Technology and Innovation
NACRTE	- The Needs Assessment on Curriculum Reform in Teacher Education
NASMLA	- National Assessment System for Monitoring Learner Achievement
NEMIS	- National Educational Management Information System
NQF	- National Qualification Framework
PWPER	- Presidential Working Party on Education Reforms
STEM	- Science, Technology, Engineering and Mathematics

TE - Teacher Education

USA - United States of America

USAID - United States Agency for International Development

CHAPTER ONE

INTRODUCTION

This chapter dealt with the background to the problem, the statement of the problem, the purpose of the study, the objectives of the study, research hypothesis, significance of the study, scope and limitations of the study, theoretical framework, conceptual framework, and definition of terms.

1.1. Background to the study

Education is an essential instrument for attaining increased autonomy, empowering individuals, and mitigating gender disparities in the allocation of opportunities and resources (Muganda, 2002; Muthaka & Mwangi, 2002). An fair allocation of opportunities and resources between genders directly contributes to enhanced economic growth and productivity (World Development Report, 2000/2001). Kenya instituted formal schooling during the British colonial period. The education system established from 1964 to 1985 adhered to a 7-4-2-3 structure, comprising seven years of basic education, four years of secondary education, and three years of university education (Kinuthia, 2009). The 8-4-4 system of education was implemented in January 1985. This decision was made because to concerns that the prior basic education did not have sufficient content to effectively encourage widespread and sustainable self-employment. A 1995 examination of the curriculum found that there was a significant amount of work required in the different disciplines taught in both elementary and secondary education. According to the 1999 Report on "Total Integration of Quality Education and Training," a needs assessment was conducted. The study findings revealed an excessive number of

subjects at the primary level, an overwhelming amount of content for each subject at both the primary and secondary levels, and a notable repetition of content across different subjects. In 2002, the national curriculum for primary and secondary school underwent a revision to eliminate excessive content and unneeded redundancies within and between classes, while also incorporating developing topics. KIE (2002) states that in basic education, the subjects of Music, Art, and Craft were combined into a single study area known as creative arts. The subject field known as Science encompasses the integration of Home Science, Agriculture, and Science, while also incorporating elements of technology. The course known as Geography, History and Civics (GHC) was rebranded as Social Studies, encompassing environmental education, civic education, and elements of Business Studies. The prominent issues that were given significant attention included HIV/AIDS, child labour, environmental preservation, and gender concerns, among others (KIE, 2002).

The rationalization of secondary education involved reducing the number of topics and the content within those subjects in order to alleviate excessive workload. Specialized information that was considered job-oriented was excluded from all disciplines and reserved for higher education and training. The essential skills previously learned through the Business Education subjects were restructured to be taught in the new integrated Business Studies Subject. These encompassed essential elements of economics, accounting, trade, and office procedures. The instruction of English and Kiswahili was to be conducted utilizing the integrated approach. An intentional effort was made to address the increasing concerns, such as health, environmental and civic education, gender, and the expected industrial development of the country (KIE, 2002).

The increasing need for 21st century skills and the integration of technology into daily life, along with the globalization of the job market, have impacted the nature and significance of the learning and teaching process. This has led to the necessity of ensuring that everyone acquires new key competencies for their personal and social development (Pamier, 2017). The 2016 report by the Kenya Institute of Curriculum Development (KICD) on the assessment of educational needs in Kenya states that the evaluation of primary and secondary education in 2009 showed that the current curriculum does not prioritize practical skills needed for economic growth. These skills are taught in subjects that are not included in exams. As a result, many students who finish secondary education lack the necessary skills and abilities to enter the workforce. The report found several skills deficiencies, including agricultural skills, entrepreneurial abilities, vocational and technical skills, innovation and creativity, and ICT skills. Learners chose not to pursue these subjects.

Introduction of Curriculum reform in education is a globally implemented initiative aimed at optimizing educational processes to meet the demands of the twenty-first century, including knowledge acquisition and economic requirements. Post-independence, African nations inherited a colonial education system characterized by discrimination, necessitating realignment to the sociological and cultural needs of these countries (Koskei B.K. & Chepkemboi E., 2020).

The 2-6-3-3-3 education system, a significant alteration from the 8-4-4 system, was instituted in 2017. The Competency Based Curriculum (CBC) comprises two years of pre-primary education, six years of primary education, three years of junior high, three years of senior high, and three years of university. school reforms assert that all children,

particularly those from underprivileged communities and individuals with impairments, must have access to school (KICD, 2017). The origins of CBC emphasized flexible learning and prioritized the learner over the teacher or instructor (Deißinger & Hellwig, 2011; Hodge, 2007). The Competency-Based Curriculum (CBC) aligns more closely with the principles of lifelong learning, which advocate for education in informal, formal, and non-formal settings (Amutabi and Oketch, 2009; Menéndez & Morales-Menendez, 2016). Amutabi (2019) states that numerous countries, including Finland, Germany, South Africa, the Netherlands, and Norway, have established their own competency frameworks that address the training program demands of the local population in relation to their competency criteria. Kenya has introduced the CBC, tailored to its unique dynamics and requirements, in pursuit of an alternative development model as proposed by experts like Walter Rodney (Rodney, 1994). Kiprotich (2020) notes that Competence-Based Education has evolved over the past century, taking on many different forms before the phrase and idea took hold in the 1960s, starting in the US. By assisting students in acquiring Competency through the development of required competencies, CBC should accept the task of preparing students for both the workplace and society. Africa embraced CBC to satisfy the demand for qualified workers ready to use their abilities in resolving global difficulties and competing in the international market. Competence-Based Education (CBE) was desirable to match education with society's social and economic demands. The Tanzania Institute of Education (TIE) modified the secondary school curricula to give graduates the skills they need to succeed in academics and society today.

A CBC structures education around the specific needs and capabilities of individual learners within a flexible framework that may adjust according to their requirements. The curriculum denotes a structured progression of knowledge and abilities that students are anticipated to acquire within an educational institution or a particular course (UNESCO, 2015). Amutabi and Nsenga (2019) define CBC as a type of communal learning in which the teacher and students collaborate to develop answers and solutions to both straightforward and complicated learning needs that benefit humanity. Based on their unique abilities and needs, all students should have equal access to a basic education, and that is the goal of the CBC. Education reforms aim to level the playing field so that all students, especially those from disadvantaged families or with disabilities, have the chance to attend school (KICD, 2017).

Competency, as described by Jeng'ere (2017), refers to the capacity to effectively utilize learning resources such as skills, knowledge, ethics, and attitudes in different real-life scenarios, including educational, job, personal, or professional development settings. However, according to Claro (2009), competence is defined as the combination of knowledge, abilities, and attitudes that are necessary for achieving success in a society that is based on knowledge. In the Competency-Based Approach, learners are expected to receive resources with which they engage and derive meaning from (Barman, 2011). The Spanish Education Act (2006) states that a Competency Based Curriculum is a curriculum that includes core competencies as an integral part of the curriculum and assessment. The curriculum is determined by a sequence of desired results, fundamental abilities, subject matter, and standards for evaluation (Annadio 2009). In his book "Milkman" published in 2017, the author says that Competency Based Education

establishes a need for learners to demonstrate complete mastery of specific knowledge and skills before they can move on to more advanced material.

Carraccio, Wolfsthal, Englander, Ferentz, and Martin (2002) propose a systematic method to curriculum design for the implementation of Competency-Based education in different centers worldwide. The authors additionally outline the four primary stages as follows: firstly, the requirement to identify competencies; secondly, establishing the elements of the competency and the anticipated levels of performance, which encompass professional duties that either individually or collectively constitute the competency. The tasks function as performance indicators or benchmarks that must be quantifiable as a whole in order to assess the attainment of a skill. Performance criteria should provide the minimum level required to demonstrate the competencies. To assess whether the competence has been attained or not, it is necessary to establish the expected performance level for each benchmark. Furthermore, the evaluation of competency can be conducted using preferred methods, such as criterion-referenced measures that compare performance against established standards or thresholds. Additionally, an overall assessment of the process can help program implementers identify areas that can be improved to enhance efficiency. This implies that the teaching and learning process must shift its focus from simply memorizing factual information to acquiring practical skills and competences that are applicable to solving real-world situations (Woods, 2008; World Bank, 2011).

Kamario and Otieno (2022) examine the impact of CBC on students' academic performance: A study of schools in Arusha City Council, Tanzania. The research was grounded in social constructivism theory and employed a convergent mixed methods

design, with 142 participants: 30 instructors, 90 learners, 10 school heads, 10 quality assurance and standards officials, 1 WEO, and 1 DEO. The study demonstrated a robust substantial positive correlation between the CBC and pupils' academic performance.

Literature agrees that secondary education is currently the most rapidly expanding area of the education system (SEIA 2001; UNESCO 2001; Mulkeen et al., 2005; World Bank 2005; Di Gropello, 2006; World Bank, 2007). There is a shift from perceiving primary education as the final stage of education to policies that aim for the extensive completion of lower and upper secondary education as objectives for the development of education systems in numerous Latin American, African, and Southeast Asian nations (De Ferranti, 2003; World Bank 2005). The transition from the longstanding policy emphasis on primary education occurred in 1995 when funders' strategic focus began to shift towards basic education, encompassing both primary and lower secondary levels. Contemporary students require secondary education to equip them with the technical, academic, and life skills necessary for contributing to their nations' economic growth (World Bank, 2005). According to Shiundu and Omulando (1992), curriculum development is a process comprising several stages: conducting a situational analysis, formulating objectives, establishing the curriculum project, constructing the program, piloting the new program in selected schools, refining the new program, implementing it, evaluating, and maintaining it. Consequently, the adoption of the CBC approach in educational institutions necessitates a comprehensive transformation of pedagogical methodologies, encompassing instructional techniques, learning strategies, and evaluation protocols. Consequently, teacher education programs must be revised to equip both pre-service and in-service Teachers with the requisite skills to effectively navigate the challenges

associated with the implementation of the CBC in educational institutions (Woods, 2008; Kitta & Tilya, 2010).

The Competence Based Curriculum necessitates comprehensive and efficient teacher training; however, at the time of implementation, a limited number of teachers had received training, and many of those trained reported uncertainty regarding the application of the Competence Based Curriculum (Sifuna and Obonyo, 2019). The Competence Based Curriculum necessitates comprehensive training for Teachers ; however, during the initial implementation phase, only a limited number of teachers received training, and many of those trained reported uncertainty regarding the application of the curriculum. This curriculum typically necessitates small class sizes to enable teachers to provide individualized attention to each student. However, Muraya (2019) observes that the Competency-Based Curriculum for early childhood education was implemented in pre-primary 1 and 2, as well as grades 1, 2, and 3 nationwide in early January 2019. The transition from the 8-4-4 to the 2-6-3-3-3 education system has been challenging as the government establishes the necessary groundwork. Therefore, a forecast of Teachers and additional necessities must be established to provide the seamless execution of the CBC at the Senior School levels in 2026. Elimu Library (2019) reported that the Cabinet Secretary for Education identified several challenges associated with the CBC, including inadequate environments for learners to achieve outcomes, insufficient resources in certain community and government schools, hasty implementation, and a shortage of adequately trained Teachers . The limited number of Teachers educated for the new curriculum contrasts sharply with the large student population in the country, compounded by inadequate infrastructure, as the curriculum necessitates contemporary classrooms, smart boards, laboratories, creative centers, and

technology across all levels. She observed that the curriculum is currently established up to grade three; however, the necessary infrastructures have not been implemented. KNA (July 2019) The Kenya News Agency reported that the primary problems hindering the implementation of the Competency Based Curriculum (CBC) in Makueni County, Kenya, are a scarcity of teachers, insufficient infrastructure, and inadequate teacher training. This study seeks to develop models for the prerequisites necessary to implement the Competency-Based Curriculum in Senior Secondary schools in Kenya by 2026.

1.2 Statement of the problem

For a nation to realize its educational goals, it requires a curriculum that is pragmatic and relevant to its requirements. Consequently, periodic amendments and enhancements of curricula are essential to accommodate evolving eras and requirements. Consequently, nations have transitioned their curricula from content-based to competency-based teaching and learning methodologies (UNESCO, 2015). The change has been necessitated by the globalization of the labor market and the necessity for the acquisition of twenty-first century skills. The Kenyan government implemented the 8-4-4 education system in January 1985 with the aim of producing graduates who had self-sufficiency. Nevertheless, the 8-4-4 education system grew too focused on examinations, which led to the introduction of the CBC. The 2-6-3-3-3 schooling system was initiated in 2017. Comparative studies have shown that flexibility in CBC has made the system popular in many developed countries (Ninomiya; Nakaya; Shimomura & Sato, 2004). Practitioners are also given credit so that they get some exemptions as they join new or higher strands or levels (Anderson & Krathwohl, 2001). This calls for flexible rules and regulations that

are best handled by individual training institutions and not regulators with their rigid schemes (Dilmore; Moore; & Bjork, 2011). The realization of AU through NEPAD has created huge impetus for indigenous knowledge systems, which are recognized in CBC and lifelong learning (Semali & Stambach, 1997; Sifuna & Obonyo, 2019). This curriculum is currently being implemented in Pre-Primary 1, Pre-Primary 2, as well as in lower primary and Junior Secondary Schools. Competency-Based Curriculum focuses on a learner-centred approach, highlighting the development of practical skills and competencies across various learning areas, rather than merely memorizing facts, with a strong emphasis on collaboration, critical thinking, creativity, and digital literacy, all while tracking individual student progress through continuous assessment methods. The educational program is structured to encompass a duration of two years in pre-primary, six years in primary education, three years in Junior Secondary education, three years in Senior Secondary education, and three years at the university level. However, since it started it had several challenges which started in advance of the enrollment by some shareholders discarding it. Some of the issues that were raised at that time have come to haunt the implementation and the government needs to take measures to ensure learners are not disadvantaged. A number of the challenges are low teacher-learner ratio, inadequate infrastructure, teacher training issues, understaffing, and lack of parental support among others. The government should provide more resources both physical and human and ensure teachers are well-trained on CBC curriculum implementation. In order for schools to effectively administer a curriculum, it is essential that they have teachers who possess the necessary knowledge, skills, and competence to handle the curriculum. The instructor is anticipated to serve as a facilitator in the process of teaching and learning. The availability and adequacy of instructional materials for the Competency-

Based Curriculum is essential for its implementation. In 2016, USAID, in partnership with the Ministry of Education, enhanced its support for the implementation of the CBC inside the education system. This support encompassed financial aid to enable the development of the curriculum and the manufacture of educational materials. This project involved the organization of multiple workshops to execute the curriculum. Moreover, teaching materials, including books, were developed, and Teachers participated in a seven-day training program during the August holiday of 2017 (IBE-UNESCO, 2017). Consequently, the curriculum was employed for assessment reasons, ranging from pre-primary one to grade two. One year later, external reports emerged, revealing holes that necessitated attention. In 2018, the Chairperson of the Kenya Publishers Association voiced doubts on the execution of the new curriculum, highlighting the lack of published resources. Waweru (2018) noted a deficiency of instructional materials in public primary schools in Nyandarua North Sub-County, Kenya, during his investigation of the influence of teacher preparedness on the execution of the CBC, except for resources pertaining to mathematics and language activities. In December 2017, the Kenya National Union of Teachers (KNUT) addressed a letter to the cabinet secretary of education, articulating concerns on the hasty implementation of the new system, which was devoid of effective planning, suitable educational resources for pupils, and sufficient training for Teachers.

Amutabi (2019) observes that the Competency Based Curriculum (CBC) inside the 2-6-3-3 educational framework in Kenya possesses significant potential to revolutionize the struggling education sector, which is currently exam-centric and fosters minimal innovation across all educational tiers. The Competency Based Curriculum (CBC) has yielded remarkable developmental outcomes in nations where it has been adopted, as it

eschews an emphasis on examinations and fosters numerous opportunities for learners' career advancement. This educational approach aligns with the National Qualification Framework (NQF), which endorses lifelong learning by acknowledging learning occurring in formal, non-formal, and informal contexts, as well as prior learning (Tuck, 2007). Kenya possesses a National Qualifications Framework and will facilitate the implementation of Competency-Based Curriculum beyond primary education with ease. CBC must exhibit adaptability across both basic and higher education to achieve success (Hitchcock, 2013). Kenya must promptly ensure that the existing higher education system aligns with CBC objectives, particularly on flexibility and learner-centeredness (Kouwenhoven, 2009). As demonstrated by CBC experiences in other regions, the nation must brace itself for 14-year-old university graduates and 24-year-old PhD holders, necessitating a complete overhaul of existing laws, norms, and regulations. They must prepare for academics possessing a singular degree and university instructors in indigenous knowledge systems who lack a university degree but possess experiential knowledge from the University of Life and the informal and non-formal sectors (Mascarenhas, 2003; Mkapa, 2004).

The Competency-Based Curriculum is expected to foster holistic learning, alleviating the strain associated with national tests that engender intense and detrimental competition among stakeholders (Amutabi, 2019). The rivalry has fostered corruption among stakeholders, with the majority preoccupied with garnering publicity. This has fostered cheating and corruption inside Kenya's education system, favoring the elite. Consensus has emerged that Kenya requires a new curriculum to supplant the contentious 8-4-4 system, which has become reliant on examinations and has fostered corruption (Ambaa, 2015; Amutabi, 2003a, 2003b). CBC is supportive of science, contrary to the hypothesis

that its implementation will lead all students to choose the less challenging paths of liberal arts and humanities (Mohamed & Karuku, 2017). Students may pursue pure and practical sciences, humanities, social sciences, or a combination of these disciplines that they find comfortable (Amutabi, 2019).

Preparations for the implementation of the Competency-Based Curriculum must be thorough to adequately equip teachers and schools for its effective execution. An effective implementation of the curriculum necessitates a positive approach by Teachers . Therefore, teachers' viewpoints on the curriculum are essential, as they are accountable for its execution. Teachers are the primary stakeholders in the execution of any curriculum. This implies that if they are inadequately equipped, they will be unable to impart the same knowledge to their learners. Understaffing has long been an issue in Kenyan schools, even during the 8.4.4 system. The implementation of CBC necessitates increased monitoring and teacher-learner interaction, resulting in a reduced number of learners assigned to each teacher. Currently, several courses at public schools exceed 50 students each, rendering management under the new curriculum unfeasible. The government enlisted Teachers for Junior Secondary Schools; nonetheless, the majority of institutions received merely one or two teachers. It is unfeasible for a single instructor, or even four, to instruct all subjects in one class. The government must allocate funds annually to augment the number of instructors in schools as the implementation of the Competency-Based Curriculum advances to Senior Secondary Schools in 2026..

Nonetheless, there is limited indication of any preparations made for the execution of the Competency-Based Curriculum. Nyaboke et al. (2021), in their study titled 'CBC Implementation in Kenya and the Challenge of Vision 2030,' employed a descriptive

survey study design, incorporating literary criticism and literary appreciation to achieve the aims of their research. Scholars recognize that the CBC aims to cultivate the 4Cs: Communication, Collaboration, Critical Thinking, and Creativity skills, which are essential for achieving quality education as outlined in Sustainable Development Goal 4, serving as a fundamental component of Kenya Vision 2030. Their study identifies significant deficiencies in the CBC implementation process that will undoubtedly hinder the attainment of quality education. The government, via the Ministry of Education, has conducted training; nonetheless, the results have been unsatisfactory. It is unrealistic to expect an individual to be trained on a new curriculum within a week and thereafter utilize that knowledge for instruction. The CBC curriculum is a resource-intensive pedagogical approach that necessitates extensive engagement to attain proficiency. This indicates that further resources are necessary, which most schools presently lack.

Ground-level physical preparations must be undertaken to improve facilities, including forecasts of essential resources such as Teachers, instructional materials, infrastructure, and student enrollment for junior and senior secondary schools in 2024 and 2026, respectively. Despite schools and Teachers being urged to adopt innovative practices and utilize locally accessible resources, the implementation remains a difficulty. The adoption of the Senior Secondary curriculum is forthcoming. This necessitates a systematic approach to provide a smooth transition from Primary School (Grade 6) to Junior Secondary School and ultimately to Senior Secondary School in 2026. This study aims to develop projection models for specific requirements in the implementation of the Competency-Based Curriculum in Senior Secondary Schools in Kenya for 2026.

1.3 Purpose of the study

Enrolment projections are vital for government and planners to allocate education related resources and ensure necessary school requirements such as infrastructure, teachers, books and funding are provided. Although the National Educational Management Information System (NEMIS) school data is available, there is little evidence that this data has been used to come up with future enrolment projections. This study filled this gap by developing projection models for the implementation of CBC in Senior schools in 2026. Thus, the purpose of this study was to model projections of selected requirements for the implementation of Competency Based Curriculum in Senior Secondary Schools in Kenya.

1.4 Objectives of the study

The objectives of this study were:

- i) To project the enrolment progression trends of Grade 1 2017 CBC cohort into Senior Secondary Schools in 2026 in Kenya.
- ii) To model projections of teacher requirements for the implementation of the CBC in Senior Secondary Schools in Kenya.
- iii) To model projections of infrastructure requirements for the implementation of the CBC in Senior Secondary Schools in Kenya.
- iv) To model projections of textbook requirements for the implementation of the CBC in Senior Secondary Schools in Kenya.

- v) To model projections on Subsidised Secondary Education capitation requirements for the implementation of the CBC in Senior Secondary Schools in 2026 in Kenya.

1.4.1 Research Questions

The study was guided by the following research questions:

- i) What is the enrolment progression trends of grade 1 2017 CBC cohort into Senior Secondary schools in 2026 in Kenya?
- ii) What is the projection of teacher requirements for the implementation of CBC in Senior Secondary Schools in Kenya?
- iii) What is the projection of infrastructure requirements for the implementation of CBC in Senior Secondary Schools in Kenya?
- iv) What is the projection of textbook requirements for the implementation of CBC in Senior Secondary Schools in Kenya?
- v) What is the projection of Subsidised Secondary Education capitation requirements for the implementation of CBC in Senior Secondary Schools in 2026 in Kenya?

1.5 Significance of the study

Stakeholders in Kenya's education system will use this study's findings to gauge the country's preparedness for the 2026 implementation of the CBC in Senior Secondary Schools. Findings from the enrollment projections will help the Ministry of Education (MoE), the Kenya Institute of Curriculum Development (KICD), and the Teachers Service Commission (TSC) establish effective teacher training programs, meet the

demand for senior secondary level infrastructure, and ensure that there are enough textbooks for instruction. The results of this study will enable the planners to make informed judgments on the placement of schools, the required number of school spaces, and the provision of necessary school facilities and resources (Campbell, 1997). The MOE will utilize the results derived from teacher projections to develop in-service activities that specifically focus on teaching and learning using a CBC approach in Senior Secondary Schools. Schools may encounter unforeseen enrollment challenges and experience disruptions in teaching as a result of insufficient teaching staff, facilities, or equipment. Given the projected enrollment figures for Senior Secondary Schools in 2026, stakeholders will find it more convenient to allocate budgets. This can be attributed to the fluctuating sizes and makeup of the school population, as well as the often constrained budgetary resources allocated to schools.

1.6 Justification of the study

The CBC enhances education to meet the dynamic social and economic needs of the community. This curriculum enhances proficiency in skills and knowledge while fostering self-confidence in problem-solving, which is crucial for the job market. CBC equips academics with essential life and career competencies, encompassing leadership, interpersonal relations, adaptability, compliance, self-motivation, responsibility, efficiency, accountability, social acumen, and cross-cultural proficiency. These traits are crucial for the transition to the labor market and community engagement. The curriculum's ability to swiftly adapt to society's changing demands is crucial for its relevance and effectiveness. In 2002, a review was conducted on the current elementary and high school curriculum. Subsequently, there was an evaluation of the main curriculum for teacher education in 2004, the curriculum for special education in 2006,

and the curriculum for diploma teacher education in 2007. Thus, it fails to conform to the current demands and aspirations of the country, as articulated in several policy documents. The MOE acknowledges the need to completely revamp the curriculum of secondary schools, with an emphasis on shifting from just reproducing knowledge to actively generating knowledge. Curriculum reform is making improvements or changes to the current curriculum with the aim of attaining a higher standard or degree of excellence.

The 2-6-3-3-3 CBC system, which was introduced in 2017, underwent a two-year pilot phase before being implemented in 2019. The implementation began in Junior Schools in 2023, and it is scheduled to expand to Senior Secondary Schools in 2026. Therefore, it is necessary to make early preparations. This study aims to create a model that predicts student enrolment, classroom needs, textbook needs, instructor needs, and FSE capitation for the adoption of CBC in Senior Secondary Schools in the year 2026.

1.7 Scope and Limitation of the Study

1.7.1 Scope of the Study

The study was restricted to secondary schools and projections of enrolment, teachers, infrastructure, textbooks, and Free Secondary School funding for the implementation of Competency Based Curriculum.

Data on schools to offer Science, Technology, Engineering and Mathematics (STEM) pathway was not covered because it was not known which schools will fall in this category. However, the study would have been more comprehensive if the pathway for each school was known.

1.7.2 Limitations of the study.

The study was limited since there are few studies for comparison as it is a new area and that the projections would be based on existing enrolment and yet enrolment is a continuous process thus some students may enrol along the way.

The study was also limited to the fact that we could not project enrolment along pathways because even the government has not presented a sensational paper on the pathways and which Senior schools will offer them. If pathways for each school were known, then the results would have been more accurate.

Ad hoc changes in policies about training, hiring, deploying, and transferring teachers could have an unplanned effect on the trends and forecasts of the need for teachers and the factors that determine that need. The utilization of long-term data was aimed at mitigating the impact of unpredictable fluctuations on the established trends and projections.

The study relied on data supplied by the principals and teachers in elementary and high schools. This group of participants expressed skepticism regarding the purpose and application of the study, which initially led them to withhold the necessary information. The study was constrained by its reliance on questionnaires and observations as data collection methods, which may not fully capture the psychological features of the respondents. These aspects could provide valuable insights into the respondents' mental state, attitudes, and other influencing variables. The researchers obtained an introduction letter from the University and a research permission from the National Commission for Science Technology and Innovation (NACOSTI), which confirmed that the study was

purely academic in nature. The study explicitly guaranteed the respondents that their names and any personal identification were not necessary in the questionnaires. The researcher has extensive expertise and advanced understanding of the nature, culture, and social orientation of the individuals, enabling seamless access to the respondents while respecting cultural and religious boundaries. The researcher, who had prior experience in the county, found it effortless to identify and locate all the primary and secondary schools.

1.8 Assumptions of the study

The study made these assumptions.

That there has been a concern that enrolment, financial and infrastructural records are hardly available in school, this study assumed that proper and updated records on pupil enrolments for the Grade one 2017 and Grade two 2018 cohorts are available in schools.

That CBC enrolment at Senior Secondary School level will definitely kick off in the year 2026.

The CBC Senior Secondary School program will be established at the existing Secondary Schools, with the majority of current teachers participating in its implementation.

The student enrollment served as an indicator of demographic trends, hence the impact of population fluctuations on the demand for Teachers was contingent upon enrollment figures.

1.9 Theoretical Framework

Faludi and Needham's 1973 rational comprehensive (Synoptic) planning theory served as the foundation for this research. Since most other planning approaches build on the rational comprehensive theory's foundational four steps—(1) establishing objectives, (2) identifying policy options, (3) assessing means in relation to desired outcomes, and (4) executing policy—it has become the de facto standard. Multiple iterations, feedback loops, and sub-process elaboration are possible in this planning process. Theories like these make it possible to conduct evaluations using tools like cost-benefit analyses, systems analysis, operations research, and forecasting research. There are two main types of rational planning forecasting models: deterministic models that use econometric modeling, multiple regression analysis, and trend extrapolation, and probability envelopes and contingency models that take expected pattern changes into consideration. Furthermore, comprehensive planning theory often takes a systems view, using mathematical or conceptual models to link goals with available resources and constraints; this approach places a premium on numerical data and quantitative analysis. Also, it's an algorithm, which is a set of rules for dealing with a certain type of problem. The use of quantitative methods allows it to produce optimal results in most cases. The approach has widespread use in the fields of operations research, trend forecasting, linear programming, and input-output analysis. The rational comprehensive planning theory, which seeks to create a systematic framework of objective decision-making criteria and analysis, was therefore applied in this paper. The theory's adaptability to different operating settings and ability to address a wide range of issues make it very adaptable. Similarly, the theory possesses an internally coherent and self-reinforcing network of methodologies and data prerequisites. The theory promotes a comprehensive approach

to planning that encompasses all aspects without imposing any limitations on the scope of planning. It enables long-term planning for a country's entire education system, typically spanning five or more years. This involves using trend extrapolation and quantitative analysis. In this particular research, it is relevant because it pertains to the projection plan for implementing the CBC at Senior Secondary Schools in the year 2026.

This theory was suitable for this research as it focuses on the projections of enrolment, teachers, textbooks, classrooms that may help to successfully implement a new curriculum in Senior Secondary Schools in 2026.

1.10 Conceptual Framework

A conceptual framework, as defined by Mugenda and Mugenda (2007), is a diagrammatic depiction of the interrelations among the variables being examined. The dependent variable was the execution of the Competency-Based Curriculum in Senior Secondary Schools in Kenya. The independent factors included forecasts for teacher needs, chosen infrastructure, educational resources, subsidized secondary school funding, and the enrollment of first-grade students in 2017.

The problem was conceptualized as represented in Figure 1.1.

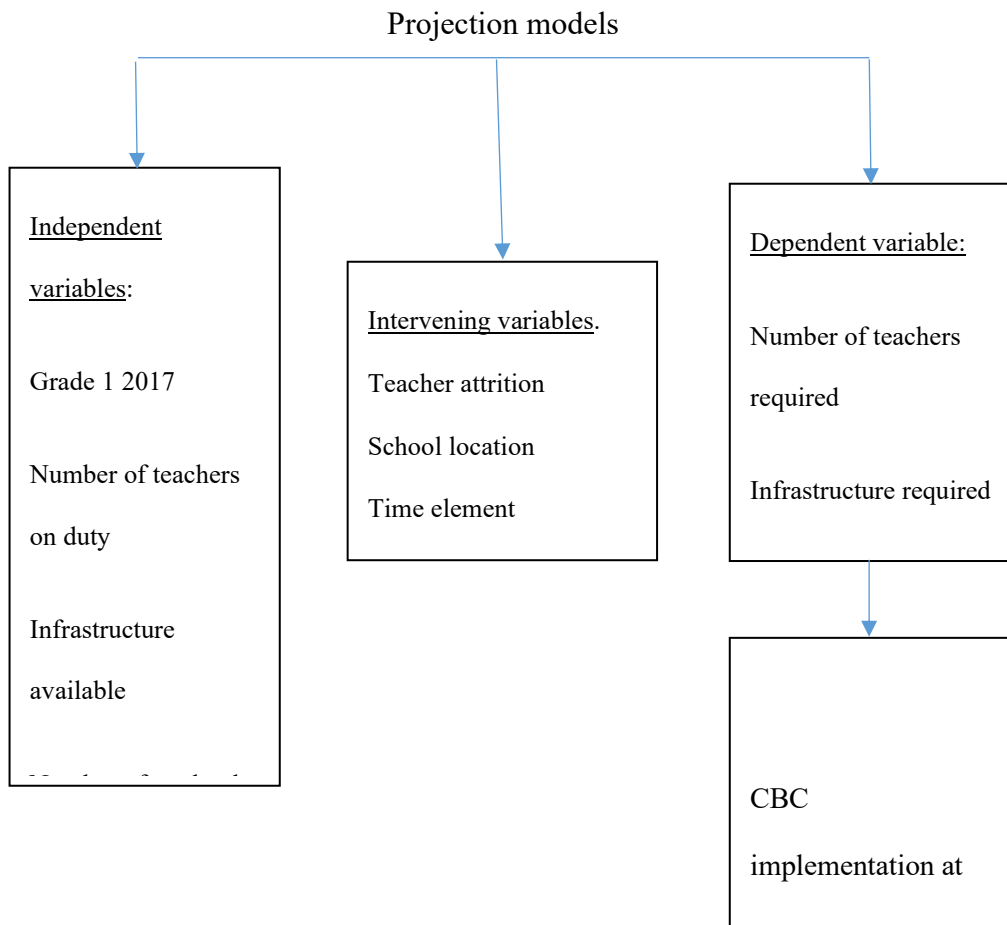


Figure 1. 1: Conceptual framework showing the relationship between Senior Secondary Schools preparedness and the implementation of CBC in Kenya

Source: Researcher.

The researcher projected the enrolment to Senior Secondary School in 2026. With these numbers, the researcher went ahead to project number of teachers, classrooms and textbooks required. The researcher also projected subsidized secondary education capitation for Senior Secondary Schools for CBC implementation in 2026. All these indicators were reflected on CBC implementation to establish whether the CBC will be successfully implemented in 2026.

1.11 Operational Definition of Terms

This section provides operational definition of terms which are significant to the study.

Competency-Based Curriculum (CBC) refers to an educational program that focuses on the practical application of knowledge, skills, attitudes, and values in real-world circumstances, rather than simply acquiring information.

Curriculum reform refer to the modifications that have been implemented and are still being suggested in the framework of education in Kenya.

Implementation refers to the act of implementing or putting into effect something that has been formally determined to commence, occur, or be utilized, specifically in this instance, the curriculum.

Textbooks refers to the literature that the educator employs to clarify abstract concepts. In this instance, these are course materials that are compatible with CBC.

Projection approximates of future values based on a current trend in relation to a time series.

Projections of enrolment is the predictable number of pupils or students at a certain level of learning in the approaching years.

Projections of teachers is the approximate number of teachers required to teach in a given year in the future.

Projections of infrastructure is predictable number of classrooms, toilets, laboratories, dining facilities and boarding facilities required for use in the future most likely due to an anticipated increase in enrolment.

Pupil Teacher Ratio is the ratio of students to teachers in a Senior Secondary School.

CHAPTER TWO

LITERATURE REVIEW

2.1. Introduction

The broad objective of the study was to model projections for requirements of the implementation of Competency Based Curriculum (CBC) in Senior Secondary Schools in 2026 in Kenya. Literature was reviewed on key variables of the study; projected enrolment in Senior Secondary School in 2026, selected infrastructure, textbooks and teacher requirements for the implementation of CBC in Senior Secondary Schools and Free Secondary Education capitation for the implementation of CBC in Senior Secondary Schools in 2026.

2.2. Background of Competency Based Curriculum Implementation

Competency-Based Curriculum carries a new inclination on the influence of African education with the rest of the world. Many African states have embraced CBC with an aim of getting answers to the limited needs of the general public. In the developed countries where the curriculum has been applied, instrumental growth has been realized in the contribution to the standards of the graduates. Most countries have opted for a competency-based curriculum, which seems as worldwide trends in contributing skills that match with the desires of the society and the establishments.

Competence encompasses the information, abilities, and attitudes necessary for an individual to do tasks effectively in both academic and professional environments (Mosha, 2012). Kouwenhoven (2003) defines competence as the capacity to select and implement a cohesive amalgamation of skills, knowledge, and attitudes to accomplish a task within a specific context. From this viewpoint, competency is characterized as the capacity of learners to engage in a particular task, establishing standards that emphasize their abilities rather than their knowledge. A competence-based curriculum is an educational framework designed to develop students' ability to acquire knowledge and perform tasks to meet established requirements. A competence-based syllabus incorporates explicit result statements that illustrate the capabilities to be achieved. Mosha (2012) asserts that a competency-based curriculum is designed to cultivate in learners the ability to perform, acquire knowledge, and understand the process of learning itself.

Empirical evidence indicates that effective teaching methods are learner-centered and employ pedagogical strategies that promote cooperation, inquiry, reflective and analytical thinking, creativity, and problem-solving among learners (Vavrus et al., 2011). Students must cultivate these intricate skills to effectively assess the extensive information accessible via technology; this necessity persists regardless of whether they pursue careers as manual laborers or managers (Vavrus et al., 2011). When Teachers provide learners with critical thinking and problem-solving abilities, students develop a

profound comprehension of the material and acquire the competences necessary to thrive in the dynamic 21st century and to be responsible citizens (Katiba & Ji, 2017).

The competency-based curriculum is deemed appropriate for meeting the evolving social demands and technical socio-economic challenges of the nation for sustainable development. Critical thinking, problem-solving, and creativity are essential elements of competency-based curriculum or competency-based education (CBC or CBE). Prior research indicates that the implementation of a CBC enhances students' problem-solving abilities, critical thinking, and lifelong learning skills; additionally, it fosters greater self-efficacy, peer engagement, and conceptual comprehension of the material (c.f. Bostic et al., 2016; Choi & Woo, 2020; Koo, 2020; Kwak, 2019; Muthersbaugh et al., 2014; Strait, 2008; Lucey et al., 2018; Yuruk et al., 2009). Thus, the implementation of CBC improves students' preparedness for both further education and professional pursuits (Blumenthal & Rasmussen, 2015; Levine & Patrick, 2019). The initiative seeks to tackle adolescent and graduate unemployment by focusing on the acquisition of essential skills, knowledge, behaviors, and attitudes necessary for performing diverse tasks (Maodzwa-Taruvinga & Cross, 2012). The competency-based curriculum, as described by Wangeja (2010), emphasizes the construction of knowledge rather than its transmission, with past knowledge influencing the learning process. This represents a transition from traditional input-driven education, mostly centered on knowledge acquisition, to competence-based education (Young, 2009). It emphasizes the development of skills as a synthesis of values, knowledge, and attitudes necessary for executing various activities (Mulder, 2014).

Rwanda transitioned to the CBC to facilitate an educational revolution, ensuring that learning is meaningful, pleasant, and conducive to habit development, hence enhancing standards and outcomes. This affirms that the link between education and the workforce is facilitated by the CBC. It offers a curriculum framework that links practice to theory, resolving the paradox between knowing "that" and knowing "how." The program aims to develop graduates' competencies and employability skills, hence improving the practical application of knowledge. The extent to which CBC has effectuated reforms in Rwanda as anticipated, or continues to encounter implementation issues akin to those faced by numerous other developing nations, requires clarification. The implementation of the CBC in Cameroon is expected to yield graduates equipped with the information, skills, and attitudes necessary to address societal and economic concerns. In Indonesia, the CBC transformed the teacher's role from content provider to educational facilitator. They assume a pivotal position in the classroom, tasked with encouraging learners to establish educational objectives, fostering the development of critical thinking by aiding learners in the retrieval and retention of knowledge, and facilitating its application in lifelong learning practices. This entails a substantial directive for teachers for curriculum implementation, particularly for young students. However, some researchers contended that Teachers in African nations were inadequately trained in CBC, as even the policy developers had a comprehensive understanding of CBC (KNUT, 2019). Wongnaa and Boachie (2018) indicated a shortage in skills among graduates from the institution of higher education for the job market. The abilities mandated by the industry and those obtained from university seemed inadequate when compared to the competences

necessary for job performance. He elaborated that enhancing the skill level of the workforce is essential to bolster industry productivity, hence mitigating unemployment issues. The CBC was implemented in the USA in response to apprehensions of inadequate student performance and substandard teacher training. This emphasizes the necessity to organize learning outcomes in a way that motivates Teachers to articulate their instructional objectives through observable student behaviors. The strategy was believed to enhance the efficacy of schools, Teachers, and teacher training programs, while also addressing societal concerns regarding inadequate performance in teacher education in the USA. Currently, the CBC is not extensively used in primary schools in the USA. Sotco et al. (2018) noted that the CBC concept transitioned to European nations as a result of the economic slump triggered by rampant teenage unemployment in the United Kingdom. The primary criticism was directed at the education system, which was held responsible for the inadequate acquisition of essential skills by school graduates. The Europe educational system has witnessed considerable progress. The development and implementation of CBC in Tanzania stemmed from issues within the training system that adversely impacted the quality of graduates entering the labor market. The existing education system did not delineate the necessary competencies to be achieved by students upon completion of the term of study. Furthermore, with the implementation of CBC, the inquiry arises: can these competences be attained in a classroom with a substantial student population? CBC equips academics with essential life and professional competencies, encompassing leadership, interpersonal abilities, flexibility, adaptability, self-motivation, responsibility, productivity, accountability, as well as social and cross-cultural skills. These attributes are vital for the transfer to the

labor market. The CBC cultivates favorable feelings among fellow learners. The learner is informed about human rights and the importance of respect and goodwill towards others. He/She eschews all manifestations of bias. Teachers are equipped with understanding about disability mainstreaming to ensure that students with disabilities are embraced and treated with respect, equality, and dignity. The Basic Education Curriculum Framework outlines a structure for students to acquire core abilities at pre-primary, lower primary, and upper primary levels, and to specialize in several disciplines at the secondary level (KICD, 2017). This framework allows students to cultivate competencies in important skill sets for effective civic and professional environments. This framework also offers all students the opportunity to thrive in their selected pathways (NESP, 2015).

The Competence-Based Curriculum (CBC) originated from teacher preparation programs in the United States throughout the 1970s (Schilling & Koetting, 2010). This CBC mission arose from the necessity for a curriculum that directly reflects the assessments, challenges, and characteristics of a transformed society. In the 1960s, CBC was characterized as performance-oriented teacher education, noted for its thorough examination of the behavioral dimensions of professional practices (Mulder & Biemans, 2003). The demand for improved efficiency and increased output in companies has led to the development of optimal techniques to achieve objectives (Goodman, Henderson & Stenzel, 2006; Kouwenhoven, 2003). Mulder (2004) contends that competence-based education is predominantly linked to behaviorism, mastery learning, and modular instruction. The competence-based curriculum perspective emerged from dissatisfaction with post-secondary education programs. The competition involved numerous

institutions and universities offering programs lacking explicit objectives concerning the skills or identities the learners were intended to develop (Mulder, 2004).

Similar to several African nations, Kenya is marked by a significant population of unemployed young, which calls into question the quality of education provided. To mitigate this issue, the education sector in Kenya is being restructured to align with the needs and aspirations of the Kenyan populace, with an emphasis on vocational training to alleviate the rising youth unemployment, in accordance with Sessional Paper No. 1 of 2005 on the policy framework for Education, Training, and Research (Republic of Kenya, 2005).

In response to the difficulty of delivering effective education for sustainable development, Kenya is transitioning from an objectives-based curriculum to a CBC. The Competency-Based Curriculum, established in 2012 under the leadership of Professor Douglas Odhiambo, emphasizes previously neglected practical subjects (Republic of Kenya, 2012). This is attributable to the significant unemployment rate among Kenya's youth, a challenge prevalent in other African countries. According to Sessional Paper No. 1 of 2005 on the Policy Framework for Education, Training, and Research (Republic of Kenya, 2005), it is essential to prioritize vocational education and training to reduce the elevated youth unemployment rate and to align education and training in Kenya with the needs and aspirations of its populace.

The KICD research report affirmed the necessity of a primary school curriculum that integrates and equips individuals with essential competencies and skills applicable in

real-life situations both locally and globally. The statement underscored the necessity of prioritizing vocational education and practical courses within the curriculum. Therefore, to ensure effective curriculum implementation and the provision of superior education, it is essential to prioritize teacher capacity development, the accessibility of educational resources, and comprehensive teacher training encompassing both pre-service and in-service programs. The fundamental objective of the updated curriculum was to promote the cultivation of indigenous talent (Pathways to Education, 2016). The Republic of Kenya (2017) asserts that the recent curriculum modifications aim to identify, cultivate, and build educational pathways in senior secondary school, with the objective of fostering each learner's potential. Ensuring that every child in Kenya is ethical, resilient, and engaged is the paramount objective of CBC. Under the new 2-6-3-3-3 CBC system, the priorities of schools, parents, and teachers are eclipsed by those of the children. The transition from a content and teacher-centered curriculum to a competency-based curriculum enhances the value of education by enabling children to expand their abilities relevant to their lives and many applications for sustainable development (Komba & Mwandaji, 2016).

Benchmarking from countries that have undergone CBC implementation, such as the United States and South Korea, can assist Kenya in effectively executing CBC. The United States and South Korea serve as exemplary frameworks for Kenya's planning of CBC implementation, having approached it in distinct manners: the United States executed a pure CBC model in select school districts (Evans et al., 2019), whereas South Korea implemented CBC nationwide via the '5–31 Educational Reform Plan' (So et al., 2017).

The initial changes in South Korea (2015–2020) mirror the preliminary phases of educational reorganizations recently executed in Kenya. This encompasses the fulfillment of a needs assessment for the primary level curriculum conducted by the Kenya Institute of Education in 2009, as well as the application of the findings from this assessment to inform the recommendations of the Douglas Odhiambo task force for the realignment of education in alignment with Vision 2030 and the New Constitution in 2010 (Kabita & Ji, 2017; KICD, 2017). The implementation of the CBC would facilitate teacher training, enabling Teachers to effectively develop environments for students to gain critical competencies and abilities for the workforce. To assess the advancement of the CBC education reforms, President Ruto of Kenya named individuals to the Presidential Working Party on Education Reforms (PWPER) on 30 September 2022 (Ruto, 2022). The terms of reference for the PWPER, essential for improving basic education as specified in Gazette Notice No. 11920, include evaluating and proposing a suitable framework for the ongoing execution of CBC, as well as the formulation and application of fundamental principles that underpin the competency-based approach, such as value-based education, community service learning, parental empowerment, and student engagement (Ruto, 2022). The curriculum revisions in Kenya and South Korea prominently emphasized a transition from knowledge transmission to competency building by promoting higher-order thinking, critical reasoning, problem-solving, experiential learning, inquiry-based approaches, and teamwork.

The decision to investigate the CBC practice in the United States was guided by the extensive history of the US CBC implementation process. The CBC was first suggested as a framework for K-12 education in the 1970s, following Bloom's publication on mastery learning in 1968. During that period, certain school districts adopted elements of CBC; nevertheless, discrepancies in term definitions, the formulation of enforceable policies, and the lack of evidence about program efficacy hindered the nationwide deployment of CBC in the USA (Spady, 1977). The implementation of CBC in elementary and secondary education in the USA has risen since the onset of the 21st century, as many states have modified their high school graduation requirements to incorporate assessments that demonstrate topic mastery (Deye, 2018; Evans et al., 2019). Effective CBC implementation in the USA has transpired in educational institutions that emphasize pedagogical principles such as deeper learning, student-centered learning, and personalized learning, which may yield insights for enhanced learning outcomes and foster demand-driven human capital development in post-secondary institutions (Hernández & Darling-Hammond, 2019). The decentralized education system in the USA contrasts with Kenya's centralized governance structure; however, the challenges encountered by state education departments in the USA while implementing CBC at elementary, intermediate, and high school levels may not significantly differ from those faced in Kenya since the introduction of CBC in 2017. Consequently, comprehending the tactics employed in the USA at different phases of implementation could guide the reconceptualization of the curriculum and the redesign of professional development programs in Kenya as the curriculum approaches implementation at the Senior School level.

Kamario and Otieno (2022) regarding the impact of CBC on students' educational attainment: A study of schools in Arusha City Council, Tanzania, was underpinned by social constructivism theory and employed a convergent mixed techniques methodology. Data were gathered by questionnaires and interview schedules, comprising a sample of 142 respondents: 30 teachers, 90 students, 10 heads of schools, 10 Quality Assurance and Standards Officers (QUASOs), one WEO, and QT, with a reliability coefficient of $\tau = 0.82$. Findings suggested that the utilization of teacher-centered and learner-centered approaches, along with distributions, displays, practical activities, and projects, was promoted. Furthermore, the adoption of CBC is crucial for students' future job advancement by fostering self-employment, creativity, innovation, talent exploration, and the enhancement of diverse abilities required for sustainable growth. Research findings suggest that CBC should be systematically applied in all secondary schools to facilitate the development of essential abilities for personal change among students.

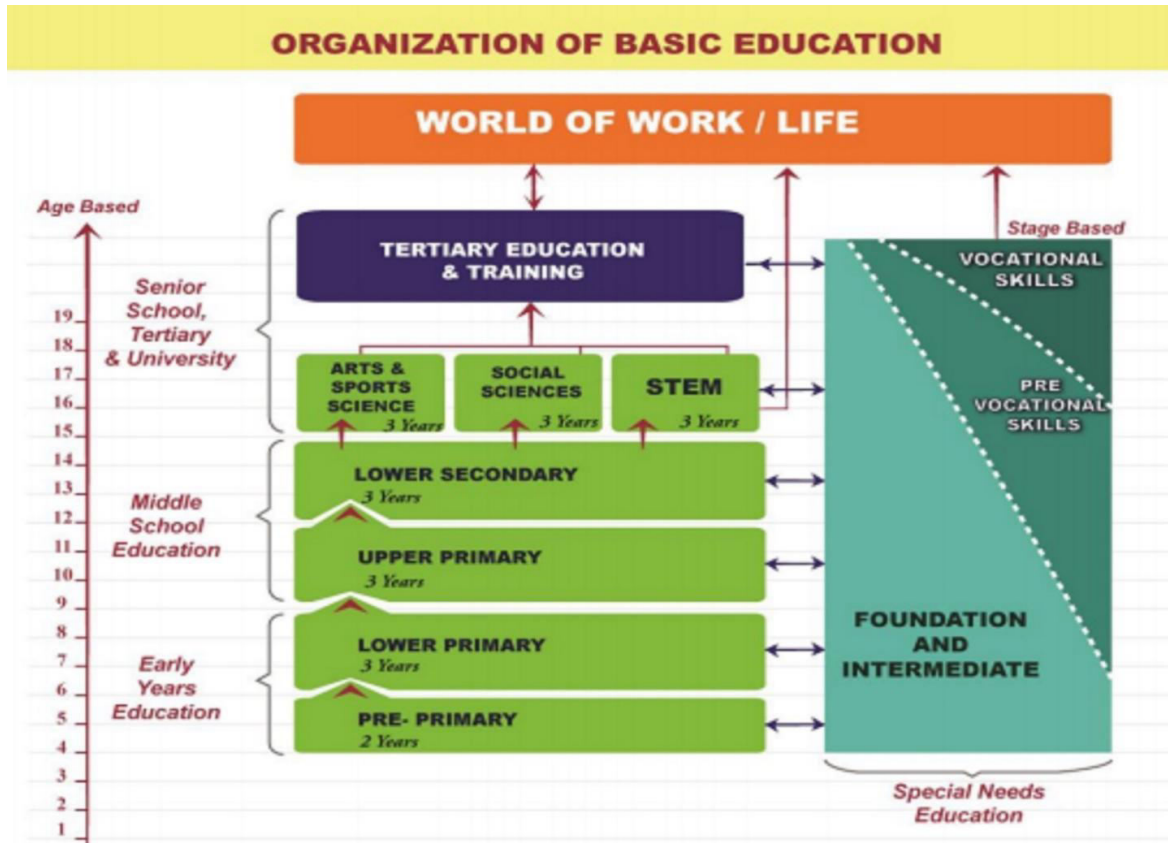


Figure 2. 1: Basic Education Structural Model. (BECF 2017)

Kamario and Otieno (2022) examine the impact of CBC on students' academic performance in schools under the Arusha City Council, Tanzania. The study was grounded in social constructivism theory and employed a convergent mixed methods design, involving 142 respondents: 30 instructors, 90 learners, 10 school heads, 10 quality assurance and standards officers, 1 WEO, and 1 DEO. The study demonstrated a robust substantial positive correlation between the CBC and pupils' academic performance.

Mugabo, Ozawa, and Nkundabakura (2021) conducted a case study in Rwanda examining the correlation between a school's profile and its ability to implement CBC. The study's findings revealed that discrepancies in the implementation of CBC among

instructors were attributable to disparities in their professional growth, insufficient training on CBC, inadequate teaching and learning materials, and a lack of infrastructural capability within the schools. The study advised the supply of sufficient teaching resources and the implementation of robust and regular in-service training programs to assist teachers in implementing the new concepts effectively. The data from the analyzed study indicates that insufficient instructional resources and inadequate teacher training can impede curriculum implementation. Consequently, it is essential to formulate forecasts necessary for the seamless execution of CBC in Senior Secondary Schools.

2.3. Enrolment projections

Total enrolment refers to the number of students in the primary school age group who are enrolled in either primary or secondary education. It is stated as a percentage of the total population in that age group. The primary enrolment rate for Kenya in 2012 was 86.21%. Kenya's primary school enrollment had significant fluctuations in recent years, but overall it showed an upward trend from 2001 to 2012, reaching a rate of 86.21% in 2012.

Agboola and Adeyemi (2013) argue that student enrollment at all levels of school is essential for the nation to attain its educational objectives. Accurate enrollment data is essential for determining the number of learners in the educational system, as it directly impacts other important factors such as teacher availability, classroom capacity, textbook distribution, and funding allocation.

Enrolment figures serve as the foundation for numerous investment decisions in the field of education. Enrolment forecasts serve as the fundamental components of efficient

school planning. Countries or counties can only effectively determine the optimal location for schools, establish future-proof boundaries for school attendance areas, efficiently provide specialized programs to students, prepare for financial measures such as bonds and levies, and manage various other crucial planning activities throughout the year by relying on detailed and precise projections.

The Gross Enrolment Ratio (GER) or Net Enrolment Rate are phrases that quantify the number of children currently attending school. The Gross Enrolment Rate (GER) is a measure of the number of children admitted to a particular level of education, regardless of their age, divided by the population of the corresponding age group for that level. The Net Enrolment Rate (NER) is defined as the proportion of children in a specific age group who are enrolled in primary schools, compared to the total population of children attending school (Baluch & Shahid, 2008).

The majority of local people still prioritize conviction in matters of development, as indicated by the enrolment level (UNESCO, 2010). The most recent statistics from the Ministry of Education indicate a decrease in the Gross Enrolment Rate (GER) from 94% in 2016 to 86% in 2017 (Republic of Kenya 2012). Despite the implementation of FPE, the education sector continues to encounter numerous obstacles in terms of accessibility. Nevertheless, the elements that affect GER have not been given. Consequently, it is necessary to undertake a study in order to identify the factors that determine enrolment rates in Kenya. Every government that has followed has consistently prioritized increasing primary enrollment (UNESCO, 2011).

Since achieving independence, the government has enacted multiple policies regarding Universal Primary Education (UPE), resulting in a continuous rise in enrollment rates up to the present time. Consequently, the educational system during colonial times, which unfairly prevented Africans from pursuing higher education, was eliminated (Bogonko, 1992). The initial implementation of the FPE policy included the removal of school levies in semi-arid and desert regions for the first four years. In 1978, the FPE package was introduced, resulting in a 23.3% rise in enrolment. By 1983, at least 93% of school-age children had been enrolled. In contrast, Bogonko (1992) observes that the introduction of fees for standard five and seven resulted in a decrease in enrollment, notwithstanding the initial increase in enrollment in lower primary when education expenses were covered.

Education cost sharing was instituted in 1988 as part of the International Monetary Fund's (IMF) structural adjustment initiatives. The school's progress was supported by the parents, who had also purchased books and equipment. As a result of this mandate, families felt they couldn't afford to send their children to school (Abagi, 1997; World Bank, 1995). To speed up the achievement of EFA's goals, which sought to reach an 85% increase in enrollment, the NARC government instituted free primary education in January 2003 (Angelucci, & National Bureau of Economic Research, 2000).

The need for education in East African countries has been rising as a result of the growing number of students enrolling in primary schools. In response to the increased demand, secondary schools were expanded at the local level to accommodate the growing number of students. Nandi South Sub-County exemplifies a typical representation of a rural

sample opportunity in Kenya. Numerous challenges have been observed in this region. According to Hannum and Buchmann (2011), schools are experiencing a lack of female students, a low percentage of students progressing to higher levels of education, a high rate of students leaving school before completing their studies, and a shortage of staff. Public resources are scarce, thus governments have typically depended on the private educational sector, especially at the post-basic levels, to fulfill the additional demand. As a result, there are limitations on the ability to provide high-quality elementary and secondary education in the region (Wedgwood, 2006). Given that Kenya is not an uncommon case, the objective of the present study was to forecast the enrollment rates at Senior Secondary Schools in Kenya for the year 2026.

Upon the adoption of FPE in 2003, there was a notable 22% surge in the Net Enrolment Rate. In 2007, the national enrolment rates for Kenya were 5.0% for males and 3.0% for females, according to the Ministry of Education (2009). In 2016, the national enrolment rate was 7.46% for males and 5.48% for girls, resulting in a total dropout rate of 6.47%. Although there has been an increase in enrolment rates over the years, the rate of increase has been unpredictable (MoE, 2009). This image demonstrates that the issue of enrollment continues to be a challenge in Kenya. In 2004, there were 657,747 applicants who took the Kenya Certificate of Primary Education (KCPE) exam, compared to 587,961 candidates the previous year. This is a 12% increase, which is the highest increase in the past decade (Mkwale, Mutai, Murigi & Bartoo, 2004). The rate of transfer from primary school to secondary school has been steadily increasing throughout the years. The transition rate in 2007 increased to 47.3% from 41.7% in 2002 (Republic of

Kenya, 2008). This study aims to forecast the number of students expected to enroll in Senior Secondary Schools in Kenya for the year 2026.

According to the education Cabinet Secretary's report in 2019, there were more than 1.3 million grade 3 CBC learners in Kenya who were being educated using the new 2-6-3-3-3 system of education (The Star, 13th September 2019). The enrollment figures highlight the necessity of developing a system for predicting teacher demand in order to prevent a crisis as Grade 9 students transition into Senior Secondary, especially considering the increasing number of enrollments in the field of FSE at this level.

According to the MOE, the number of children enrolled in pre-primary schools increased in 2018. The enrollment percentages at this level, however, show that a large portion of the children who are old enough to attend preschool are not enrolled. A total of 3.4 million kids attended pre-primary schools in 2018, up from 2.8 million the previous year, according to the statistics. The net enrollment rate (NER) for pre-primary programs across the country was 77.2% in 2018. This suggests that over a quarter of the children who ought to be enrolled in pre-primary programs are not, when age and suitability for school are considered. While some of them are enrolling in elementary schools right away, the vast majority of them aren't even going to class. The data shows that pre-primary education is still not widely available in arid and semi-arid areas; for example, in Mandera County, the Net Enrollment Rate (NER) dropped to 18% in 2018 (MoE 2018). With a GPI of 0.96, there was no statistically significant difference in gender attendance at the pre-primary level in 2018 across the country. The Ministry of Education

notes that this fact masks the low enrollment rates of girls, especially in the Arid and Semi-Arid Lands (ASAL) districts.

Mbeche (2003) estimated that colleges in Kenya will enroll students in the Bachelor of Education degree to meet the demand for teachers with this background. All Integrated English teachers in Kenyan public secondary schools and all Integrated English students at Kenyan universities made up the study population. Universities in Kenya and the headquarters of the Teachers Service Commission (TSC) were the sources of the data. A search strategy based on looking back was employed. All members of the study population were surveyed and data was gathered. The primary task of data analysis is to carry out the desired predictions. To achieve this goal, the compounding relationship model was employed. Finding the average weighted survival rate and average weighted graduation rate was part of this process. In order to predict college enrollment in a way that will meet demand by 2015, the researcher used a traditional flow pattern. Means, percentages, and frequency tables were among the descriptive statistics used to examine the data. The research showed that there is a mismatch between the need for and supply of IE teachers in Kenyan public secondary schools. There were 2,895 public secondary schools in the country. These schools were dispersed in an uneven manner across the nation. Graduation rates were shown to be 0.885 times more closely related to enrolment levels at the entry stage. The current study is attempting to predict the requirements for introducing a CBC in Senior Secondary Schools by 2026, hence this research is relevant to that effort.

2.4. Teacher Projections for the implementation of CBC

Teachers represent the foundation of the educational system, and their significance in student achievement has been extensively validated by numerous research (Rivkin, Stephen, Ertik & John, 2000). Consequently, Teachers are a vital asset in the teaching and learning process, necessitating careful evaluation of their training and deployment (Ministry of Education Science and Technology, 2005a). In recent years, a growing number of studies have raised concerns regarding existing and anticipated teacher shortages in numerous countries. Santiago (2002) indicates that significant shortages persist, creating a disparity between the demand and supply of instructors necessary for effective instruction in numerous nations. Teacher shortages have consequently emerged as a significant worry for educational authorities and must be persistently addressed by policymakers. Munyao et al. (2023) conducted a survey study on teacher instructional preparedness for the implementation of the CBC in public primary schools in Lamu West Sub-County, Kenya. The study involved 211 teachers, 19 public primary schools, 19 head teachers, and 6 education officers, all selected through appropriate sampling methods. The study determined that the practicing instructors in the assessed public elementary schools lacked the necessary ICT abilities for the application of the CBC digital competencies. The demonstrated deficiency in knowledge, abilities, and attitudes hindered the attainment of essential educational competencies in the 21st-century community.

The provision of quality education mostly depends on teachers' abilities to interpret and execute the curriculum. This entails organizing the educational setting in alignment with

prevailing trends and the requirements of learners. The majority of Teachers will necessitate reorientation about the instructional methodologies for the competency-based strategy. To foster innovation, experiential learning, and creativity, it is essential to utilize technology for teaching and learning, both in the classroom and through remote modes, as several countries globally have successfully implemented. Numerous youngsters who choose adaptable learning schedules due to various limitations could attain quality upper primary and secondary education via an open schooling system. This technology can enhance and advance Teachers' abilities and expertise. Consequently, pre-service and in-service training programs must be structured to align with the philosophical and theoretical frameworks established in the proposed school curriculum..

A study by Munyui et al. (2023) demonstrated that insufficient engagement of teachers in the curriculum preparation process hinders the effective implementation of a CBC. Therefore, it is essential to involve Teachers during the implementation phases, including their engagement in technical working groups that assess curriculum deficiencies to enhance pedagogical abilities and methodologies. Teachers can participate in government-funded action research to more effectively identify obstacles in the implementation process and provide recommendations for addressing these issues. For instance, in South Korea, Teachers participated in action-oriented research regarding the implementation of Competency-Based Curriculum (So et al., 2017). The financial assistance provided to the instructors facilitated knowledge creation during the implementation of the programs in their schools (So et al., 2017). Teachers can serve as catalysts for pedagogical transformation and enhance student relevance by connecting classroom experiences to real-world contexts (Hamre & Pianta, 2010; Zee & Koomen,

2016). These activities can enhance students' capacity to employ meta-cognitive skills, promote critical thinking, intensify cognitive processing, and broaden comprehension (Hamre & Pianta, 2010; Zee & Koomen, 2016). This experience will so enhance instructors' self-efficacy about the instruction of creativity, critical thinking, and problem-solving skills.

Makunga (2016) discusses the problems confronting Teachers in the implementation of the CBC in Tanzania. The study on Community Secondary Schools in Tanzania employed a survey design, with a sample of 102 teachers, 6 head teachers, and 6 academic directors. Findings revealed that Teachers encounter numerous problems in the implementation of CBC in schools, including insufficient parental involvement and the isolation of teachers from the curriculum design process. The discovery has ramifications for the ministry of education to actively involve Teachers in the development of curriculum design for the effective implementation of CBC.

One of the primary obstacles to the implementation of South Korean educational reforms was ensuring teacher readiness to effectively execute the new curriculum (Munyui et al., 2023). The Kenyan government intends to invest on teacher training during the initial phases of CBC implementation. South Korean recommendations for enhancing their implementation of CBC encompassed teacher training for the provision of quality skills and knowledge (Hong & Lee, 2012; Park, 2009; Shon, 2011; So, 2007; Yoon et al., 2007). Funding for teacher professional development is a crucial element in executing changes and policies. Evaluating teacher training can provide a dependable source of information regarding the efficacy of the suggested practices, pedagogical methods, and

the immediate learning results that can improve evidence-based policy interventions. To successfully implement CBC, the Kenyan State Department for Early Learning and Basic Education must collaborate with the Teachers Service Commission and educational training organizations to create effective in-service and pre-service professional development programs. Kenya can emulate the United States' 1968 government grant initiative for universities and colleges to establish exemplary training programs. These programs were established to address the deficiency of competency-based training for Teachers and the recognition that students' successful acquisition of competencies relies on the proficiency of their teachers. The programs were defined by "the exact delineation of competencies or behaviors to be acquired, the modular organization of instruction, assessment and feedback, customization, and practical experience" (Tuxworth, 1989).

Headteachers have a crucial role in ensuring the attainment of quality education at the elementary level (Waruingi et al., 2022). The elements of curriculum implementation in educational institutions are primarily influenced by the quality and competence of the school leader, specifically the head teacher (Rowland, 2017). Headteachers affect curriculum execution, teachers' performance, the quality of the educational environment, and student learning in schools (Manna, 2015). According to Chepkonga (2017), head teachers must be well-versed in curriculum implementation to guarantee success. In this context, it is the responsibility of head teachers to oversee the extent to which the activities of parents, teachers, and students are executed to fulfill the requirements of curriculum implementation, thereby holding them accountable for accomplishing curriculum objectives. These actions of leadership and change management pertain to the head teacher's level.

Despite their obligations to achieve educational objectives, teachers require ongoing training and continual professional development programs to be informed about the evolving dynamics of education (Tingle et al., 2017). In the United States, numerous school administrators lacked access to ongoing professional development pertinent to the evolving instructional methods, technological advancements, curriculum modifications, and shifting demographics within their institutions (Darling Hammond et al., 2009; School Leaders Network, 2014). Although head teachers are anticipated to consistently participate in instructional leadership, teacher assessment, and coaching, Grissom et al. (2013) discovered that the majority of school leaders allocate a significant portion of their time to administrative responsibilities, including management, discipline enforcement, fundraising, budgeting, and communication with students and teachers. This postponed the curriculum implementation process, leading to suboptimal academic performance for children.

In response to the growing demand for schools to exhibit the delivery of quality education in the contemporary era, there is a necessity for head teachers who are transformative and eager to learn. Waruingi et al. (2022) stated that this can occur only if head teachers obtain the requisite training to effectively guide the implementation of the new curriculum. Head teachers can receive training via in-service training, induction programs, professional development, short courses, and networking (benchmarking) with other schools and institutions (Mathibe, 2007). These training programs are anticipated to be customized to align with educational objectives, guided by a definitive long-term strategy, primarily adapted to primary school contexts, and designed to be continuous with frameworks for monitoring and evaluation (Rowland, 2017). The

educational curriculum, pedagogy, and learning methodologies must evolve in response to society's shifting requirements (UNESCO, 2015). Numerous countries worldwide have modified their educational systems to align with the evolving demands of a dynamic society (IBE-UNESCO, 2015). One of the reforms is the implementation of CBC in numerous nations worldwide. Kenya is in the midst of introducing a competency-based curriculum in its education system.

The transition from a content-based to a competency-based curriculum necessitates alterations in instructional methods; thus, thorough teacher induction in competency-based curriculum should be prioritized for its implementation (Kafyulilo & Rugambuka 2012). Zeiger (2018) asserts that instructors are the primary executors of the curriculum; hence, they must possess substantial knowledge, skills, and talents to integrate all components to establish an effective learning environment. KICD (2017) asserts that Teachers must deliberately include the elements of the CBC into lesson plans and possess extensive knowledge of the teaching practices required to facilitate active and effective learning. Jeng'ere (2017) asserts that for effective teaching and learning in schools, Teachers must possess pedagogical knowledge and abilities to incorporate components of the Competency-Based Curriculum, including core competencies, into their instruction. This indicates that teacher training is essential for the effective implementation of CBC in schools (Isaboke, et al 2021). Teachers are crucial in facilitating opportunities for students to acquire knowledge and realize their potential. According to Zeiger (2018), within the framework of the CBC, Teachers must reframe their approach from instruction to learning and implement formative assessments to evaluate students' progress. Likewise, Syomwene (2017) emphasizes that Teachers must

consider their additional obligations regarding the relationships established between the curriculum and students throughout instruction.

Isaboke et al. (2021) assert that Teachers require knowledge and abilities to effectively employ suitable pedagogical methods, formulate lesson plans, create assessment tools, and select relevant instructional resources that cater to students at varying levels. Jeng'ere (2017) underscores the necessity of preparing reflective lesson plans for the effective implementation of CBC. Farrel (2012) defines a lesson plan as a written document that delineates the processes, topic, resources, duration, and learning environment utilized in instruction. Research has been undertaken to determine the impact of training teachers in lesson preparation on curriculum implementation. Mokuu (2010) conducted a study to assess the impact of training primary school teachers as essential agents in curriculum implementation in South Africa. The findings indicated that teachers are essential in executing the curriculum; thus, it is recommended that South Africa train teachers in the preparation of effective lesson plans for the new curriculum prior to their involvement in the implementation process. This indicates that prioritizing teacher preparation is essential prior to the implementation of a new curriculum. The analyzed study was performed in elementary schools in South Africa; the results may not be applicable to Kenya. Consequently, it was essential to determine the anticipated number of teachers needed for the implementation of CBC in Senior Secondary Schools in Kenya by 2026.

Recent study indicates that implementation gaps are linked to inadequate preparedness by government, school management, and Teachers (Akala, 2021). Research undertaken

in several regions of the country, including Marakwet East Sub County, continues to indicate inadequate implementation of the competency-based curriculum in Kenya's basic education sector. To completely realize CBC, head teachers must be re-skilled and schooled in CBC, as they are pivotal to its implementation (Akala, 2021). May et al. (2012) asserts that a headteacher's capacity to lead a new curriculum is contingent upon their comprehension of the subject and their knowledge thereof, which can only be achieved through sufficient training. Waweru (2018) contended that, with the implementation of the CBC curriculum, headteachers should undergo retraining or participate in in-service courses. The CBC was successfully adopted in Canada, Scotland, and Finland because to the comprehensive training of administrators and teachers, ensuring their proper preparation (Saram & Susan, 2014). Nevertheless, none of the research advanced in forecasting the necessary prerequisites for the adoption of CBC in Senior Secondary Schools in 2026.

Numerous experts contend that Teachers in African nations are inadequately taught in CBC, and even the policy formulators lack a comprehensive understanding of CBC (KNUT, 2019). Wongnaa and Boachie (2018) indicated a lack in skills among graduates from higher education institutions, as demanded by the employment market. He advocated for an enhancement of abilities within the workforce to bolster industrial productivity, hence aiding in the resolution of unemployment challenges. From the conceptualization to the initiation of the CBC implementation, the contentious issue among stakeholders has been the preparedness of the tutors to execute the various curricula. In light of significant expansion and the generation of new information within an economy-driven society, Teachers must be sufficiently equipped to embrace a

sophisticated, adaptive strategy in response to curriculum modifications (Gatlin, 2009). The teaching profession should evolve procedurally, grounded in an enhanced responsiveness to the training needs dictated by socio-economic changes, to augment teachers' competencies and expertise in executing the CBC (Serdenciuc, 2013). A research conducted in Tanzania by Makunja (2016) on the obstacles faced by instructors in implementing the competency-based curriculum revealed that teachers had not received adequate orientation to prepare them for its execution. The results indicated that insufficient teacher preparation was hindering the implementation of the Competency Based Curriculum. The instructors, who are essential participants, lacked the requisite knowledge, abilities, and understanding for the efficient implementation of the competency-based curriculum. This is acknowledged in Kenya due to the grievances expressed by stakeholders, particularly teacher unions. Nonetheless, government initiatives to organize workshops aimed at sensitizing teachers on the CBC have faced criticism for being executed hastily and failing to engage all Teachers. Sossion (2019) asserts that the teacher union, particularly the Kenya National Union of Teachers, will not participate in the implementation of the Competency Based Curriculum due to the inadequacy of teachers in possessing the necessary technical expertise, prerequisite skills, and competencies to interpret the designs of the Competency Based Curriculum. A study conducted by Mosioma (2018) regarding teachers' readiness for the implementation of the CBC in private preschools within Dagoretti North Sub-County, Nairobi City County, revealed that a majority (45.2%) affirmed their complete preparedness in subject matter knowledge for executing the curriculum, whereas (44.1%) expressed disagreement.

A concerning 44.1% reported that they lack sufficient subject area knowledge to effectively administer the competency-based program. This is likely to have a detrimental impact on the implementation of the competency-based curriculum. In Rwanda, all Teachers received training; nonetheless, some resisted change. Teachers were noted to be well-acquainted with the traditional methodology, and some preferred to retain previous teaching materials rather than modify them to align with the new methodology (Urunana, 2018). Koo (2020) noted that Teachers were uncertain regarding their methodology for competency-based education (CBC) and thus favored a hybrid of traditional (textbook-centered) and competency-based (achievement-centered) pedagogies. Choi (2018) revealed that Teachers required more explicit guidance on implementing CBC, teaching and assessment methods, altering school atmosphere, and modifying their perspectives of CBC. Choi (2018) contended that the effective execution of CBC necessitated assisting Teachers in comprehending the relationship between skills and content knowledge in teaching, as well as evaluating how CBC fosters that relationship. Numerous chosen studies indicated insufficient support for implementing CBC as a barrier to its successful execution. Koo (2020) discovered that instructors lacked help from both the school and higher-level officials, advocating for comprehensive assistance from schools, students, parents, and the educational office. Ryu and Jin (2016) asserted the necessity of assisting Teachers in restructuring course content and resources through a real-life oriented approach, as well as in developing suitable pedagogy, learning modalities, and assessment methodologies. To enhance teaching and learning and establish a competency-based education system rather than a knowledge-based one, the development of a workbook in lieu of a textbook, the adoption

of a performance-oriented approach in classroom instruction, and the modification of evaluation techniques to correspond with the curricular shift were recommended (Cho, 2017; Choi, 2018).

A research by Muneja (2015) in Tanzania underscored the difficulties encountered by secondary school teachers in executing the CBC. The study indicated that Teachers encountered numerous problems that adversely affected the execution of the program. The prominent obstacles encountered by teachers in Tanzania encompass insufficient knowledge of teaching and evaluation methodologies, a scarcity of acceptable textbooks, and the substandard quality of instructional resources. The analysis indicated insufficient ICT resources for education and teachers' lack of enthusiasm to execute the program. The report recommended that the Ministry of Education and Culture provide in-service training programs for Teachers to alter their attitudes on curriculum implementation and ensure the provision of sufficient materials and infrastructure in all schools. This study was conducted in Tanzania; hence, the findings may not be applicable to Kenyan schools. Consequently, a research was necessary to simulate the needs for implementing CBC at Senior School in Vihiga County in 2026.

Komba and Mwandanji (2015) examined the challenges associated with the implementation of CBC in secondary schools in Tanzania. The findings revealed that 86% of the teachers possessed insufficient understanding on the curriculum. Moreover, the study indicated that the majority (78%) of the analyzed lesson plans failed to exhibit the characteristics of a competence-based lesson plan. Furthermore, it was revealed that the engagement of students in classroom activities by teachers was generally low, with

fewer than 50% of the observed Teachers implementing formative assessment. The researcher concluded that CBC was ineffectively implemented in the sampled schools and recommended regular training for in-service teachers to equip them with contemporary teaching skills necessitated by the curriculum changes.

The Rwandan government has implemented solutions, including the establishment of Teacher Resource Centres (TRC) managed by teachers, as they also endeavor to provide resources for the CBC. These centers provide training for pre-primary and primary Teachers, as well as tutors from Teacher Training Colleges, on the creation and utilization of teaching aids. The instructional materials are constructed using locally sourced resources. The Teachers in these centers are instructed on the utilization of these teaching and learning resources. Pre-service teachers established a club to generate resources after courses, which they then share with nearby elementary schools (Urunana, 2018).

Teachers must possess adequate technology skills to transition seamlessly from obsolete instructional materials to innovative digital tools in the new curriculum. Buageng-Andoh (2012) indicates a growing demand for the integration of ICT in educational institutions for the dissemination of knowledge and skills necessary for the 21st Century. A study by Chege (2014) examining factors affecting teachers' preparedness to utilize ICT in public secondary schools in Gatundu North Sub-County, Kiambu County, indicated that merely 13.75 percent of teachers expressed high confidence in their ICT teaching capabilities. The majority of teachers lack adequate technological skills to implement ICT in the classroom. The survey additionally revealed that numerous teachers

advocated for training to enhance their proficiency in ICT. This situation reflects the current position across the entire country, since little progress has been made in ICT literacy. A research by Mosioma (2018) on teachers' readiness for the implementation of the CBC in private preschools in Dagoretti North Sub-County, Nairobi City County, indicated that the majority of preschool instructors (61.3%) had not been exposed to ICT, while only (38.7%) had received such exposure. Findings indicated that the majority (67.7%) acknowledged their competence in ICT usage as below average and reported a deficiency in technological skills. This suggests that the implementation and delivery of the curriculum will be hindered by insufficient teacher exposure to ICT and inadequate technological proficiency. A report by KICD (2018) on competency-based curriculum activities revealed that 61 percent of teachers lack training in ICT integration. This indicates that digital literacy, as a vital competency area, may not be fully achieved due to existing challenges.

At the primary level, Teachers represent the most critical academic element, and their salaries comprise a substantial amount of the continuous educational expenditures. Consequently, CBC need tutors who are impartial and will not provide favorable evaluations based on affection rather than the quality of their students' work. Teachers require training, as demonstrated in the United States and other nations, to effectively implement CBC (Alake-Tuenter; Biemans; Tobi; Wals; Oosterheet & Mulder, 2012). Amutabi (2019) asserts that CBC requires a comprehensive cultural transformation, distancing itself from the emotional ties of relationships and friendships prevalent in African societies. Teacher requirements are anticipated based on enrollment projections. Sifuna and Obonyo (2019) identified deficiencies in the training sessions and duration,

resulting in teachers lacking essential knowledge and abilities regarding the Competency-Based Curriculum. This indicates that Teachers predominantly possess insufficient knowledge and abilities for the effective implementation of CBC. Arun (2004) asserts that the predominant methods utilized for teacher predictions are the Pupil-Teacher Ratio and the approach that considers the quantity of children per class with the hours taught by a teacher.

Teachers are the fundamental element of the education system, and their importance in student success has been thoroughly substantiated by substantial study (Rivkin, Stephen, Ertik & John, 2000). Teachers are integral to the teaching and learning process, necessitating careful consideration of their training and utilization. Recent years have seen an increasing number of studies highlighting worries regarding the current and impending shortage of teachers in many countries. Santiago (2002) asserts that numerous countries are experiencing severe shortages and an inadequate supply of instructors to fulfill the demand for proficient education. The problem of teacher shortages has emerged as a critical concern for educational authorities and necessitates continuous attention from policymakers.

Rupai (2022) conducted a literature review on the roles of teachers in managing learning materials for the implementation of CBC. The study recognizes the pivotal role of teachers in operationalizing the CBC, which encompasses fostering learner motivation, eliciting prior knowledge, stimulating critical thinking and creativity, facilitating communication and collaboration, and enhancing interactive skills. It also addresses the need to accommodate individual differences and promote inclusivity for learners from

diverse backgrounds, employing various learning techniques and a multimedia approach to ensure effective learner-centered strategies that optimize educational outcomes.

Teachers are anticipated to have difficulties when executing a new curriculum. Wambua and Waweru (2019) emphasized the obstacles encountered in implementing CBC across all public primary schools in Machakos County. The study determined that Teachers were not equipped for the execution of CBC, and there was a deficiency of personnel, poor infrastructure, and a lack of sufficient teaching and learning resources. The report advised the Ministry of Education to allocate additional resources for teacher training and to engage Teachers in the curriculum reform process to foster positive attitudes towards the curriculum for its implementation. The study identifies several problems obstructing the efficient implementation of CBC, although it exclusively concentrated on lower primary schools. Consequently, it is essential to ascertain the challenges confronting pre-primary school teachers in executing the Curriculum.

Makunga (2016) conducted a study on the problems encountered by teachers in the implementation of the CBC in Tanzania. The study on Community Secondary Schools in Tanzania employed a survey design, with a sample of 102 teachers, 6 head teachers, and 6 academic directors. Findings revealed that Teachers encounter numerous obstacles in the execution of CBC in schools, including insufficient parental involvement and the isolation of teachers from the curriculum design process. The discovery has ramifications for the Ministry of Education to actively involve Teachers in the development of curriculum design for the effective implementation of the CBC. An paper titled “Constraints Facing Successful Implementation of the Competency-Based

Curriculum in Kenya” authored by Muasya and Waweru (2019) discusses core competencies. The study revealed that the implementation of the CBC faced obstacles due to the absence of established communication channels within schools, which hindered the execution of the new curriculum. Furthermore, it was determined that a significant majority (86%) of teacher respondents lacked a comprehensive understanding of the CBC and were uninformed about its objectives.

Qualified Teachers , present in both developed and developing countries, represent the highest cost of education and pose significant challenges in recruitment within the teaching profession (World Bank, 2005). Lewin (2005) and UIS (2006) indicate that secondary schools outside the public system frequently hire unqualified teachers or those on contractual agreements. Moore, Destefano, Terway, and Balwanz (2008) discovered that the practices employed for hiring, retaining, and assigning instructors are inadequate. Nonetheless, there is a paucity of studies examining secondary school education and the extent to which the absence of skilled instructors hinders growth (Scott, 2001; Lewin, 2002). Research indicates that there have been minimal, if any, successful initiatives to enhance the recruitment, retention, and retraining of secondary school teachers (Lewin, 2002; World Bank, 2005).

The World Bank (2005) reports that qualified instructors in both rich and developing nations are more difficult to attract and retain, and they represent the highest educational costs. Research demonstrates the frequent utilization of under-qualified or contract teachers in secondary schools functioning outside the public system (Lewin, 2005; UIS, 2006). A study conducted by Moore, Destefano, Terway, and Balwanz (2008) indicated

that teacher recruitment, retention, and deployment are inadequate and ineffective. Nonetheless, a limited number of studies have examined the deficiency of trained instructors as a barrier to systemic expansion, especially in secondary education (Scott, 2001; Lewin, 2002). Research indicates that there have been minimal, if any, initiatives aimed at enhancing the recruitment, retention, and retraining of secondary school teachers that have produced significant, favorable outcomes (Lewin, 2002; World Bank, 2005).

Teacher training within the curriculum can affect the implementation process, as demonstrated by Molapo (2018), who conducted a study to determine how grade 3 teachers in Limpopo primary schools, South Africa, executed the new curriculum. The survey indicated that most grade three instructors lacked the necessary skills and expertise for curriculum implementation, which impeded the process. This indicates that insufficient teacher training obstructs the successful execution of a curriculum. A study by Ambei and Kim (2018) was undertaken in Cameroon to determine the degree of implementation of CBC by teachers in primary schools. The results revealed that most teachers had not yet comprehended the essence of the CBC. The survey further highlighted that even certified teachers with some knowledge of the curriculum faced significant challenges in its implementation due to low resources and a lack of expertise in resource improvisation. The study advised that educational stakeholders in Cameroon must collaborate to ensure that instructors possess the necessary expertise for effective curriculum implementation and are provided with sufficient instructional resources. This study demonstrates that the implementation of CBC may be obstructed by teachers' insufficient knowledge and skills about the curriculum.

A study by Handwe and Mpofu (2017) investigated primary school teachers' readiness to execute a newly established grade three curriculum in Zimbabwe, focusing on their competency in producing lesson plans that correspond with the new curriculum. The results indicated that the training provided to instructors was insufficient to meet their demands for developing successful lesson plans. The study indicated that the Ministry of Education should implement short courses to address instructors' knowledge deficiencies about the curriculum. This indicates that it is essential for Teachers to receive training on the preparation of lesson plans when curriculum modifications necessitate various elements of these plans. A study by Zhuwale and Shumba (2017) examined the teacher-related variables that obstructed the effective implementation of the curriculum in rural schools of Zimbabwe. The study indicated that teachers' insufficient pedagogical understanding about the integration of curricular elements into instruction was the primary obstacle impeding curriculum implementation. The report advocated for extensive training of Teachers on the curriculum. This indicates that training is essential for the proper integration of diverse elements of a program. Nonetheless, the study was conducted in Zimbabwe, which presents a distinct setting from Kenya; hence, the findings are not locally applicable. Consequently, it was essential to ascertain the degree of training received by pre-primary school teachers in Kenya regarding the CBC and their capacity to incorporate core skills into instruction.

The existing staffing model in Kenyan secondary schools was established by a significant policy reform enacted in 1984, which introduced the Curriculum Based Establishment (CBE) that mandated a minimum teaching load of 27 lessons per week (MOEST, 2005b; TSC, 2007). The existing paradigm, however, fails to delineate a minimum or maximum

class size and does not account for regional disparities. Moreover, the CBE neglects to consider the Arid and Semi-Arid (ASAL) regions. Exclusive dependence on the CBE may result in diminished class sizes and a low student-teacher ratio, hence leading to the underutilization of Teachers (MOEST, 2005b; Wamukuru & Muthaa, 2010). Notwithstanding the plan, teachers typically manage a teaching load of 22 lessons, suggesting they are underutilized. According to the CBE, there was a deficit of 10,287 teachers in 2007 (TSC, 2007). According to the staffing model, an estimated 6,226 teachers were unavailable in 2005 (MOEST, 2005b). In 2009, the teacher shortfall in secondary schools reached 23,291. In 1995, significant shortages were observed in science disciplines such as Chemistry, Physics, and Mathematics, although there was an excess of teachers in other areas, particularly in social sciences like Geography, History, and CRE (MOEST, 2005b; Deloitte & Touche, 1995).

Limbo et al. (2023) examine the impact of instructional supervision on the utilization of teaching and learning resources for the implementation of the CBC in pre-primary classrooms in Webuye East Sub-County, Kenya. The study employs a descriptive design, targeting 316 respondents, including a sample of 157 pre-primary teachers, one Curriculum Support Officer, and one Quality Assurance Officer. Data were gathered using interview schedules and questionnaires. The findings indicated a robust positive correlation between supervision and the utilization of teaching and learning resources among preschool teachers in the schools of Ndivisi, Mihiu, and Merdha Wards in Webuye East Sub-County, Kenya.

A survey by Education International in six Anglophone Sub-Saharan nations revealed that Gambia, Lesotho, Tanzania, and Uganda experienced a teacher shortage impacting both primary and secondary education (Sinyolo, 2007). In 2006, 44% of primary school teachers and 42% of high school teachers in Lesotho were unqualified. The study revealed that Kenya and Zambia lack sufficient instructors in their schools, as demonstrated by elevated pupil-teacher ratios, despite the presence of several trained teachers in the employment market. Teacher shortages were reported to be more severe in isolated rural regions. All six countries examined experienced a deficiency of mathematics and science Teachers . Nonetheless, the shortages are less severe in Kenya, attributable to the nation's initiative to train, hire, and retain mathematics and science Teachers (Sinyolo, 2007).

Research conducted by Mbutia (1999) indicates that around 49.25 percent of the annual demand for science instructors in Kenyan secondary schools remains unmet. The study's findings underscore the necessity of monitoring demand across various businesses and converting that interest into enrollments in pertinent teacher preparation programs. This research indicates that factors such as existing staffing regulations, the quantity of courses available, and the student-teacher ratio influence the demand for Teachers . Research conducted in Gambia indicates that the demand for teachers is influenced by factors such as class size, teacher-student ratio, and instructional responsibilities (Siniscalco, 2002). The requisite number of instructors correlates strongly with the workload in the classroom, as indicated by studies examining the availability of secondary school teachers in Tanzania (Siniscalco, 2002). These findings are pertinent

to our current research as we aim to forecast the number of instructors required in 2026 when the Senior Secondary School commences the implementation of the CBC.

Numerous projects have been executed to align Teachers' training with the Competency Based Curriculum nationwide. The NACRTE, executed by KICD in 2016, sought to ascertain the fundamental modifications desired by Kenyans in the Teacher Education (TE) sector (MoE, 2019). The study aimed to identify the prerequisites for curricular change, particularly for the enhancement of teacher abilities. It sought to develop techniques for improving the ability to detect and cultivate students' gifts and potential. The study sought to ascertain the essential requirements for instructing instructors on the identification, development, and application of resources. The objective was to identify the prerequisites for reforming the proficiency in suitable pedagogical methods and to evaluate the necessities for enhancing teachers' competencies in student assessment. This study's findings led to the development of the Teacher Education Curriculum framework, developed in 2017 to guide the assessment of teacher education. The Teacher Education Framework is founded on the Basic Education Curriculum Reform Framework (BECF), as articulated in the Ministry of Education Sessional Paper No. 1 of 2019. The foundations of TE are directly derived from the BECF. These include principles, theoretical frameworks, and guiding conceptions. The Ministry of Education (MoE, 2019) has emphasized the significance of teacher education standards as essential principles.

The TSC has identified a present deficit of 96,345 instructors. A total of 38,054 kids are registered in elementary school, whilst 58,291 students are registered in secondary

school. The anticipated shortfalls are forecast to surge by 2023, with secondary schools seeing a deficit of 84,478 and elementary schools 34,941. The rapid increase in student enrollment, driven by initiatives such as Affordable Day Secondary School Education and Free Primary Education, coupled with the establishment of new schools, is the primary reason of the current teacher shortage. The demand for secondary school teachers now exceeds supply due to rising enrollment in secondary education, driven by the goal of achieving complete transition from elementary to secondary education. The deficiency of trained Teachers has exacerbated after the implementation of the Competency Based Curriculum (MoE 2018). Moreover, there is an inequitable distribution of Teachers, a deficit of teachers, an excess of teachers, and ineffective deployment of teaching staff (MOEST, 2005b). This may indicate the absence of a framework for assessing the need for Teachers. The majority of Teachers favor employment in urban, peri-urban, and high-potential regions where social amenities are accessible (MOEST, 2005a). Consequently, the existing strategy of assigning instructors to areas with openings aims to rectify the uneven distribution of Teachers.

Okutu (2021) examined how head teachers, as street-level bureaucrats, influence the implementation of the CBC in Kenya, focusing on policy issues related to curriculum reforms. The study highlights the transition from the 8:4:4 education system to the learner-centered 2:6:3:3:3 system, which emphasizes experiential learning. This shift addresses the shortcomings of the previous system, which was predominantly content-driven and exam-focused, fostering intense competition, exam malpractice, and a lack of essential life skills expected of 21st-century graduates. The study determined that head teachers, in their pursuit of CBC implementation, are contending with policy challenges

related to supervision, insufficient manpower, a deficit in curricular materials, significant underfunding by the government via the Ministry of Education, Science and Technology, and infrastructural deficiencies. These issues are nascent, resulting in a disparity between the actual and anticipated levels of curriculum implementation practice. In light of these challenges, head teachers have adopted coping strategies that are inadequate, considering the significant deficiencies in essential curriculum implementation resources, including physical, financial, and human resources. These resources necessitate not only numerical sufficiency but also ongoing professional development through refresher courses to enhance teachers' professional growth, equipping them with the necessary attitudes, knowledge, and skills for effective execution of the CBC programs.

Student enrollment in secondary schools has steadily increased from 618,500 in 1990 to 1,180,300 in 2007, representing a gain of 90.8% (GoK, 2007). The quantity of secondary schools rose from 2,557 in 1990 to 4,236 in 2007, reflecting a 65.7% growth. The number of instructors rose at a slower rate of 58 percent, from 28,056 in 1990 to 44,305 secondary school teachers in 2007. The slower growth rate of teachers compared to the rise in the number of schools and student enrollment may adversely impact the quality of teaching and learning in Senior Secondary Schools, particularly as the government intends to implement CBC at this level in 2026.

Katam (2020) examines the dynamics of implementing the CBC in lower primary schools and its implications for learning in Kenya. The study employs a literature review and acknowledges that CBC, in contrast to the gradually phased-out 8:4:4 system, is praised for its skill-based approach, which emphasizes experiential learning and fosters

holistic development, allowing individuals to excel in areas of interest and pursue specific career pathways. Despite the initial hurdles posed by deficiencies in infrastructure, personnel, funds, and curricular materials, the CBC is poised to significantly attain the long-sought educational objectives for 21st-century global citizenship.

Waweru (2018) conducted a study to examine the influence of teachers' readiness on the execution of the Competency-Based Curriculum in public primary schools in Nyandarua North Sub-County, Kenya. The researcher employed questionnaires, interview guides, and checklists to gather data for the study, which utilized a descriptive survey research methodology. This information enabled us to comprehend the influence of teacher readiness on the implementation of the CBC. The researcher utilized a target population of 424 respondents. Three hundred thirty-six Teachers, eighty-four principals, and four curriculum support officers engaged in the study. The Statistical Package for the Social Sciences (SPSS) was employed for data analysis, with results articulated as percentages and frequencies. According to the poll, fifty percent of the teachers required assistance in integrating imagination and creativity. Regarding the incorporation of critical thinking and problem-solving skills, 69.2% of teachers acknowledged experiencing challenges. 80% of the surveyed instructors, or 98.8% of the entire sample, were unprepared to apply the CBC, particularly in the new classrooms. The study indicated that teachers lacked the requisite abilities to implement the CBC. Nearly all surveyed teachers (95 percent) expressed concern with the time commitment required to develop specific lesson plans for each class. Waweru (2018) advised that the Ministry of Education construct a training program framework focusing on infusion, assessment, and course composition.

Successful teaching and implementation of this curriculum necessitate experienced and proficient facilitators capable of employing suitable pedagogical approaches, including mentoring, coaching, and facilitation (Abuya, 2017).

Matere (2024) discusses the transition from the 8-4-4 system to the CBC in Kenya, highlighting emerging challenges through a literature study. It acknowledges the crucial contributions of key stakeholders in the implementation of the CBC curriculum, including teachers, learners, head teachers, and curriculum support officers. Deficiencies have been identified in the implementation process, including an insufficient number of teachers and inadequacies in their pedagogical knowledge, abilities, and attitudes. Deficiencies in infrastructure, money, and curricular materials. The proposed approach includes well-structured refresher courses for practicing instructors and ongoing professional development for Teachers . The government should employ additional teachers to address the impending shortfall in the teaching workforce. The government should grant sufficient financing for CBC and ensure timely disbursement to schools, while actively monitoring the wise usage of these funds in a manner that aligns with the programs' interests. The government must supply adequate curricular materials while considering the associated curriculum adjustments, regardless of their scope. The government should give additional cash for infrastructural development, including both physical and ICT needs. Comprehensive and meaningful engagement of all stakeholders, including Education Officers, school heads, teachers, students, parents, sponsors such as religious organizations, well-wishers, and development partners, including Public-Private Partnerships, on matters related to school development. This analysis aims to project the necessary cash and infrastructure to be constructed.

Momanyi and Rop (2020), in their study on teacher preparedness for the implementation of the CBC in Kenya, specifically in early grade primary schools in Bomet East, acknowledge that the rollout of the CBC was executed hastily, disregarding both teacher readiness and the adequacy of infrastructure, as well as the logistics concerning the availability of curricular materials. Nonetheless, the CBC is progressively supplanting the examination-focused 8:4:4 educational system that was implemented in 1985. Okeyo and Mokuia (2023) examined the preparedness of teachers for the implementation of the CBC in public secondary schools in Nyamira Sub-County, Kenya, utilizing a descriptive survey design with 483 participants. The primary finding indicated that Teachers were inadequately equipped for pedagogical knowledge, abilities, and attitudes necessary for the implementation of CBC, thereby obstructing its success. A study conducted by Mwang'ombe (2021) on the CBC in Kenya: An examination of teachers' comprehension and practical skills, along with the successes, problems, and recommendations for the implementation of a skill-based CBC. CBC underscores the importance of the 4Cs and digital literacy competencies. Orina (2022) examined teachers' preparedness for implementing the CBC in Science education inside public primary schools in Nairobi County, Kenya, grounded in Weiss's Theory of Change. The study employed a descriptive survey approach, involving 1,710 teachers from grades 1 to 4 in public primary schools, of which 324 were selected for participation, together with 20 head teachers and 10 Curriculum Support Officers (CSOs). Hussein (2023) examined the problems associated with the implementation of CBC in Northern Kenya by employing a survey study methodology, sampling 45 public primary school teachers and 15 head teachers for the research. The report identifies deficiencies in teacher preparedness,

curricular resources, and infrastructure, all of which hinder the proper implementation of the esteemed CBC.

Kuria (2022) examined the correlation between schools' preparedness and the effective implementation of the CBC in Nairobi County, Kenya, utilizing a survey study design. A total of 80 questionnaires were distributed to respondents, yielding a return rate of 65 (81%) from the 10 schools surveyed. The study identified deficiencies in the pedagogical readiness of practical instructors and the number of teachers involved in the implementation of the CBC programs. These findings have implications for effective stakeholder participation to provide sufficient infrastructure, adequate teacher training for the CBC, and the employment of additional teachers to enhance the success of the CBC, among other factors. Ojung'a (2023) examined the impact of teacher preparedness on the implementation of the CBC in public primary schools within Kikuyu Sub-County, Kenya, utilizing a survey study design. A total of 132 grade 6 teachers were selected from 28 public primary schools in the specified Sub-County to participate in the study. Data for the study were collected through the administration of questionnaires and interview schedules. The quantitative data collected were analyzed using SPSS software version 25, while the qualitative data obtained from interviews were analyzed thematically in accordance with the study objectives that shaped the questions addressed by the research.

Education International (EI) determined that in multiple nations within Sub-Saharan Africa, prioritization of pre-service teacher training is essential. This analysis supports the apprehensions that most of the assessed countries presently lack sufficient training

programs in this domain (EI, 2006). A 2004 study revealed that Teachers in several Sub-Saharan African nations are inadequately equipped to instruct other adults on the significance of HIV prevention, corroborating these findings. Consequently, numerous Teachers confine their responsibility to solely disseminating information to their students. When adequately trained and possessing an optimistic perspective on the issue, teachers can significantly influence education by conveying essential preventative abilities to numerous students daily (Education International (EI), 2006). Sudsomboon (2010) asserts that Teachers must transition from only delivering information to adopting the roles of coaches and facilitators to ensure the successful implementation of CBC.

In Uganda, Guloba, Wokadala, and Bategeka, (2010) investigated this phenomenon. This study's primary finding indicates that the availability of educational materials adversely impacts student achievement. Therefore, instead of solely concentrating on augmenting the number of educational resources, the government should strive to advance effective pedagogical techniques. Omaiyo (2013) conducted research in Migori, Kenya, examining the impact of course materials on students' classroom performance. The employed study methodology was a descriptive survey. The ultimate sample size was 225 children, reduced from a total of 750. The study's findings, derived from the questionnaire and observation schedule, revealed that the utilization of teaching and learning resources in these institutions was significantly low. Research demonstrated that toddlers' academic performance enhanced with the utilization of educational tools. To enhance students' academic performance, it advocated for the allocation of additional teaching and learning resources to these schools. This case, however, concentrated on a less developed region, as it is situated in a semi-rural area. This inquiry is located in a

well-developed and infrastructurally advanced peri-urban region. Consequently, it is evident that the presence of instructors is essential for the implementation of the CBC. This research aimed to develop projection models to ascertain the requirements for Kenyan senior secondary schools to implement the Competency Based Curriculum.

2.5. Infrastructure requirement for the implementation of Competency Based Curriculum.

According to the Education Sector Report (2016), the nation's secondary schools could only accommodate 80% of Kenya Certificate of Primary Education candidates for Form One due to insufficient facilities. Consequently, the advancement of infrastructure persists as a challenge for numerous firms. The education ministry's 2015 recommendations stipulate that the government, at both national and local levels, will be responsible for financing infrastructure improvements in public schools. The government has allocated KSh1.2 billion in the annual budget for this goal (<https://africacheck.org>).

The adoption of a CBC in Kenya has been a significant emphasis in the nation's education sector in recent years. The infrastructure of primary schools is a crucial factor influencing the success or failure of CBC, which must not be disregarded (Kigwilu & Akala, 2017). The implementation of CBC necessitated additional classroom space to facilitate reduced class sizes and to endorse learner-centered pedagogical approaches (Muriungi & Gachago, 2021). Nonetheless, numerous schools in Kenya, especially in Vihiga County, had constrained classroom capacity, potentially compromising the quality of education and instruction. The accessibility of potable water and sanitary

facilities is essential for fostering a healthy and conducive learning environment. Many schools, especially in Vihiga County, lack adequate sanitation facilities, including toilets and handwashing stations, which can adversely impact the health and hygiene of students and Teachers . The present analysis projected the necessary infrastructure for the adoption of a competency-based curriculum in Senior Schools in Vihiga County by 2026.

The significance of science education is in ensuring that Teachers not only instruct on scientific procedures but also facilitate sensory learners in comprehending scientific concepts. Consequently, the "hands" and "minds" of learners must engage in scientific activities, enabling them to study actively and contribute in the building of knowledge (Ausubel, 1963). The scientific laboratory directly influences students' attitudes and academic performance according to the instructional theory of learning interaction. It is widely accepted that consistent practice fosters mastery in the material acquired during classroom education; thus, the adage “practice makes perfect” (Hager, 1974). The quality of teaching and learning experiences is contingent upon the adequacy of laboratory equipment in secondary schools and the teacher's proficiency in utilizing these resources to facilitate meaningful learning for students. Akpan (2006) investigated the correlation between adequacy and academic achievement in chemistry by assessing the sufficiency of laboratory facilities by frequency counts and percentages. Lagoke (1997) investigated how the effective utilization of laboratory resources in science education fosters values that assist learners in decision-making. Okeke's (1995) research also investigated the sufficiency of laboratory facilities and their impact on academic achievement in fundamental sciences. This study demonstrated that the sufficiency of laboratory facilities bore no significant correlation with students' academic achievement

in basic science. The laboratory is a unique element in the instruction and acquisition of scientific knowledge. The adequacy of laboratory facilities for science education is contingent upon the student population of a certain school (Hofstein and Ginetta, 1998; Stuckey, 2013). In Indian schools, a teacher-to-student ratio of 1:40 is customary. What is the impact, if any, of this teacher-to-student ratio on the teaching and learning process? Academic performance reflects an individual's level of educational achievement. It distinguishes individuals with extensive knowledge from those with inferior academic competencies (Eshiet, 1996). The sufficiency of laboratory facilities has been shown to significantly impact students' academic performance in chemistry (Okafor, 2000). A study examining the impact of laboratory facility adequacy on academic performance in chemistry revealed that adequacy significantly affects students' academic performance in secondary school chemistry education (Aburime, 2004).

Indimuli asserts that for the Kenyan government to effectively implement a program of entirely free secondary education, it must assume the burden of administering regular assessment tests and establishing more classrooms and laboratories. Currently, only national-level examinations are covered. Indimuli underscored the urgent necessity for financing to construct an additional 4,000 classrooms, 740 laboratories, and other vital educational infrastructure to facilitate a comprehensive transition from primary to secondary education. Indimuli noted that the implementation of free secondary education would result in increased infrastructure needs, since students who had previously withdrawn due to financial limitations would be more likely to re-enroll.

Research by Rotich (2004) indicated that primary school head teachers in Kenya faced considerable obstacles due to a lack of physical facilities, supplies, equipment, and instruments. The data indicated that most schools had class sizes above 50 students. This study revealed that the implementation of free primary education led to problems of overcrowding, inadequate physical infrastructure, and a deficiency of skilled Teachers . This study evaluated the physical infrastructure of primary schools, whereas the current study concentrated on the anticipated models of particular infrastructure requirements for the implementation of CBC in Senior Schools in Kenya in 2026. This study will draw upon the findings of Rotich (2004) to evaluate the present state of physical infrastructure in secondary schools and ascertain the essential prerequisites for the future execution of the CBC at the senior school level.

The curriculum shift must occur within the classroom, requiring teachers to adapt their instructional methods and strategies in accordance with the curriculum document. This will allow a varied range of learners to enhance their learning capabilities (Eamon, 2005). Class size is a crucial educational measure denoting the total number of students in a classroom. Decreasing class size improves educational quality and promotes effective teaching and learning at all educational levels. This study seeks to project the number of classrooms and requisite infrastructure required by 2026 for the execution of the CBC at the Senior Secondary School level in Kenya.

The efficacy of curriculum implementation is greatly affected by the caliber of laboratory facilities. The degree to which Teachers utilize these facilities is the primary determinant affecting the outcomes of curriculum implementation. A study conducted by Ngozi and

Salisu (2015) aimed to evaluate the accessibility and usage of laboratory facilities in senior secondary schools throughout the Zaria metropolitan area in Kaduna State, Nigeria. The research employed a descriptive survey design and specifically focused on a sample of 12 government secondary schools. The assessment revealed that, of the necessary 135 Biology laboratories, only an average of 51 were accessible in the schools. Approximately 68.8% of Teachers expressed discontent regarding the limited accessibility of laboratories in educational institutions. Of the 16 instructors who offered input, 14 (87.5%) indicated that they depend on improvised laboratory facilities at their classrooms. This indicates that Teachers utilize their creativity and expertise to create educational materials using local resources, hence enhancing the learning process. A substantial percentage of students (51.8%) said that teachers did not provide practical lessons, whereas a lesser percentage (28.2%) indicated that teachers did hold practical sessions. This indicates that inefficiencies in laboratory facilities may lead to the completion of practical tasks. Moreover, a substantial majority of 62% of the Teachers reported infrequent use of laboratory facilities. In contrast, 18.7% of the Teachers indicated constant usage, while another 18.7% claimed frequent utilization. Alufohai and Aziegbe (2016) conducted a study to evaluate the impact of a French Language laboratory on the academic performance of Nigerian students studying French. The study employed a pretest-posttest control group quasi-experimental design. The findings demonstrated that pupils instructed in both language laboratory and conventional classroom environments exhibited greater competency in the French language than those taught solely in the classroom.

Consequently, it has been determined that the language laboratory is crucial for the proper execution of the French curriculum. Mercy (2016) conducted a study in India to examine the efficacy of utilizing a language laboratory for instructing seventh-grade children in English within the Coimbatore District. The study employed an experimental approach and comprised a sample of 64 students. Data was gathered through an achievement test. To compare the means of the experimental and control groups, the data was examined utilizing descriptive and inferential statistics, specifically the t-test. The findings indicated that pupils' English understanding markedly enhanced when utilizing a language laboratory. The post-test results of the control group and the experimental group exhibited substantial differences. A study by Mohamed (2017) identified a favorable correlation between the utilization of language laboratories and elevated English language proficiency levels in Saudi Arabia. The students were given a pre-test before getting training. The training was provided through audio-visual materials and recorded playback, with students utilizing earbuds and microphones. A further post-test was conducted, and the ANOVA correlation analysis revealed a significant difference in scores between the pretest and post-test. The results obtained post-test exceeded the scores achieved pre-test.

Ng'eno and Mwoma (2021) conducted a study to examine teachers' views towards the implementation of the CBC in Kenyan primary schools, using 24 Civil Society Organizations (CSOs) and 52 head teachers as participants. The results indicated that Teachers held favorable sentiments regarding CBC. They highlighted deficiencies in infrastructure, instructor availability, ICT resources, and government finance, among other factors. A viable path forward would need adequate and regular refresher courses

for practicing teachers to facilitate CBC implementation. Increased government investment for infrastructural improvement and the recruitment of additional teachers in public schools to address manpower deficiencies. This necessitates forecasts of these requirements, which the current work aims to address.

Ng'eno et al. (2021) investigated the availability of physical infrastructure for the implementation of the CBC in public primary schools in Kericho County, Kenya, utilizing a descriptive survey design. The participants included 6 Curriculum Support Officers (CSOs), 52 head teachers, and 61 grade 1 teachers. Data were gathered using interview schedules, questionnaires, and observation protocols. Findings demonstrated that infrastructure positively influenced CBC implementation, with a correlation of 0.336 and a calculated value of 0.029 for head teachers, and a correlation of 0.285 with a calculated value of 0.03 for grade 1 teachers. The deficiency of physical infrastructure, such as dietary and music rooms, yielded mean scores of 2.18 and 1.88, respectively. The response rate for Grade 1 teachers was 1.39 for nutrition and 1.35 for the music lab, respectively. The findings of head teachers' influence on teacher preparation shown a modest positive correlation of 0.494, with a computed significance value of 0.00 in relation to CBC. The grade 1 instructors exhibited a correlation of 0.369, with a computed value of 0.005, indicating significance to the study.

Sanitation facilities are essential for creating an optimal learning environment. A recent study by Ouma et al. (2021) indicates that deficient sanitary facilities, including insufficient toilets and limited water supply, adversely affect the execution of CBC.

These amenities are crucial for enabling students to stay in school for extended durations and to get potable water for consumption and hand hygiene.

The provision of energy is essential for the utilization of digital resources, like computers and projectors. According to a research by Orodho et al. (2021), numerous elementary schools in Kenya lack electrical availability, hindering teachers' capacity to effectively apply CBC. The condition of educational facilities can influence the overall learning atmosphere and the safety of students. A study by Muchiri et al. (2021) shown that substandard school infrastructure, including leaking roofs and walls, adversely affects the execution of CBC. These structures may present safety risks and divert students' attention from their academic pursuits.

Mombo (2022) on CBC in teachers' Colleges; the challenges adopted secondary data and is cognizant of the fact that many teachers training colleges have not had their course aligned towards CBC and hence a huge challenge towards their preparation for the same. The tutors too also have knowledge gaps towards CBC consequently making their knowledge dispensation to the teacher trainees towards CBC a nightmare. This calls for refresher training for the tutors prior to training of their trainees and continuous professional development for them through facilitation by educational experts organized by the ministry of education. Similarly, Namubiru et.al (2024) on perceptions of teachers on the implementation of CBC in secondary schools in Bundibugyo, and Ntoroke Districts of Uganda adopted mixed methods with a total of 397 participants drawn for 32 selected secondary schools from the two districts. The findings showed diverse perspectives amongst teacher participants most commonly featuring perceptions

indicated gaps in curricula materials, teachers' pedagogical knowledge, number of teachers, low government funding, poor infrastructure and inadequate parental/guardians' engagement. These calls for more vigilant government funding towards CBC; hiring of more teachers and giving them refreshers courses and continuous professional development for teachers. More funding towards schools' infrastructure, monitoring and evaluation of the completion of the projects. More engagement of key stakeholders in the CBC programs in schools.

A study by Nyoni (2018) on challenges facing teachers in Tanzania: The implementation of the paradigm shifts towards a CBC in ordinary secondary schools in Iringa Municipality, Tanzania adopted survey and case study design in which public secondary schools were the focus with 39 respondents consisting of 24 students, 3 school heads, and 12 teachers. Data were collected through focused group discussions and interviews and were analyzed. Findings reported respondents being alive to the fact that there was a paradigm shift in education towards CBC. However challenges bedevil the implementation process including lack of pedagogical training for teachers towards CBC operationalization and hence the practicing teachers still used the traditional teaching practices that were largely teacher centered. That teachers were also ICT illiterate and gaps in infrastructure physical and ICT were reported by the respondents. The funding towards CBC by the government is wanting with serious gaps and delayed disbursement hence the bottleneck towards effectiveness in CBC implementation.

Nazimana (2021) examined the obstacles encountered by teachers in implementing the CBC in Ugandan secondary schools, utilizing a descriptive survey design with

participants comprising 50 teachers, 4 head teachers, and 4 education officers in Gulu City, Uganda. The study's findings indicated that teachers striving to implement CBC in secondary schools in Uganda encountered several challenges, including significant infrastructural deficiencies, such as inadequate classrooms, science laboratories, computer labs, theater rooms, and CT infrastructure, among others. Teachers were lacking both in quantity and in pedagogical expertise, abilities, and attitudes necessary for the effective implementation of the initiatives in question. There exists a deficiency in adequate parental involvement, a disparity in curriculum resources, an insufficiency in governmental funding for the programs, and minimal financial support for the efficient implementation of the programs. These findings have implications for significant stakeholder participation in the programs, focusing on funding, teacher training through professional development, and ongoing support essential for the effective implementation of the CBC curricula.

Muriuki's (2022) study on factors influencing the implementation of CBC in primary schools in North Eastern Kenya utilized a survey design, using 14 head teachers, 100 teachers, and 2 QASOs as participants. Findings revealed that 65% of participating teachers reported undergoing refresher courses for CBC implementation; however, they asserted that additional continuous training programs for practicing teachers are necessary in light of new knowledge. Infrastructural deficiencies can impede the successful implementation of CBC. A limited number of teachers presents an additional challenge. Insufficient parental involvement and recurrent student absence. These challenges could be mitigated through enhanced training programs for current Teachers regarding the CBC. Increased government investment for infrastructure and the

recruitment of additional teachers would facilitate the effective implementation of the CBC.

Mikanjuola and Sidiq (2013) did a study to evaluate the essential infrastructure and amenities necessary for the efficient teaching and learning of Geography in senior secondary schools in Ekiti State, Nigeria. The results indicated that every school, without exception (100%), lacked a Geography laboratory. The examined studies were done in regions external to Tanzania. The aim of this study was to rectify this shortcoming by examining the availability of laboratories in public secondary schools in Arumeru District, with the goal of enhancing the successful implementation of the competency-based curriculum. The aim of this study was to create a model that forecasts the requisite infrastructure for the implementation of the CBC in Senior Secondary Schools in Kenya.

2.6. Textbook requirement for the implementation of CBC

Education academics are reluctant to pinpoint a single factor that is accountable for a child's academic underperformance. Nevertheless, it is commonly recognized that possessing the capability to utilize textbooks is a crucial element in improving performance(<https://www.andover.edu/>).

Access to low cost books (both print and electronic) is essential for learning and determines, to a large degree, the quality of learning outcomes. A high student book ratio cannot be sustained particularly in view of the adoption of modern teaching methodologies like in the case of TUSOME and the Early Grade Mathematics set launched in early grade classes, which call for experiential, exploratory and discovery

learning. This situation will become even more demanding when a competency-based curriculum is implemented in Senior Secondary Schools. In addition to books, other materials will be needed to support realistic learning and the requisite formative assessments. The cost of textbooks in Kenya is much higher than the cost in countries with similar economic standing. The curriculum reform process offers an ideal opportunity to re-engineer the process of developing and producing curriculum support materials that allow local significance.

A significant challenge that many parents and guardians in Kenya and throughout Africa have each January, just before the start of the new school year, is getting their children's textbooks and school uniforms. For many families already struggling to provide a decent education for their children, the exorbitant cost of textbooks makes them unaffordable. A new study by the World Bank, "Getting Textbooks to Every Child in Sub-Saharan Africa," shows how educational opportunities are constrained due to a lack of funding. According to the statistics, achieving better learning results in Sub-Saharan Africa is hindered by a lack of educational resources. In a 2010 survey, it was found that the mean number of students per textbook for reading and arithmetic in primary schools across 22 countries in the region was 1.4. The 2013 Service Delivery Indicators report states that the mean number of textbooks per student in Kenya was 3.1. Moreover, there was a notable discrepancy in the indicator. Only a small fraction, approximately 10%, of institutions did not mandate students to share textbooks. Conversely, approximately 5% of schools experienced a deficit of textbooks, with less than one textbook per five students.

Mpate (2023) on the adoption of the Competency-Based Curriculum by biology instructors in Tanzania: Challenges and Opportunities is aware that the execution of the specified programs has persisted for nearly two decades, although Teachers continue to struggle with the implementation process. The study employed a survey design with 32 participants, including school administrators, directors of Biology departments, Biology teachers, and students. Data were gathered via interviews and observations, employing thematic analysis for qualitative insights. The study determined that Biology teachers were contending with various operational challenges, including deficiencies in pedagogical practices, insufficient staffing, overcrowded classrooms, inadequate curricular materials, and insufficient infrastructure, among other initial difficulties.

Kigwilu and Akala (2017) did a study on resource use in curriculum implementation and discovered that the instructional materials were inadequate. These highlighted classrooms, workshops, and unrefined materials facilitate exploratory instruction. Although competent, the reference books remained inadequate (Keter 2023). In spite of the absence of suitable libraries, athletic facilities, and textbooks, local enterprises have entered into co-sharing partnerships with affiliated educational institutions to pool resources (Keter, 2023).

Ashiono (2018) conducted a study investigating the elements that facilitated or impeded teachers' utilization of ICT in the instruction of numeracy skills. This study's findings indicated that 4% of teachers consistently utilized ICT to instruct numeracy fundamentals. This study determined that teachers' utilization of ICT for instructing numeracy concepts in lower elementary schools was insufficient. Ngeno, Sang, and

Chemosit (2020) conducted a study on teacher computer literacy in selected elementary schools within Ainamoi Sub-County, Kericho County, Kenya. The training of computer instructors, concluded in May 2015, did not resonate with all Teachers in the area. The clarification indicated that headteachers and each school employed two lower primary teachers proficient in ICT.

The availability of educational resources, including textbooks, computers, and other digital materials, is critically inadequate in the implementation of CBC. Mwenda and Kihoro (2021) assert that the absence of access to these materials constitutes a significant challenge for numerous primary schools in Kenya. The absence of access restricts teachers' capacity to properly execute CBC and impedes learners' acquisition of essential competencies. Momanyi and Rop (2019), in their work titled "Teacher Preparedness for the Implementation of Competency-Based Curriculum in Kenya," conducted a survey of early grade primary school teachers in Bomet East Sub-County to assess the influence of resources as a problem in implementing the CBC. All interviewed CSOs (100%) expressed confidence in the materials developed by KICD, citing their comprehensive content and logical sequencing that supports the progression from prior knowledge to new insights. Learning activities designed to facilitate the development of competencies are clearly structured. This contrasts accounts from Teachers who deemed the books incomprehensible and replete with inaccuracies. Teachers perceived that instructional materials were hastily created to comply with the government's curriculum implementation timeline. The TUSOME and PRIDE programs have had minimal impact due to a lack of effort; however, Sifuna and Obonyo (2019) discovered in their study of teachers that the government's distribution and delivery of textbooks during the

implementation of the CBC was delayed, resulting in schools commencing the year without essential textbooks. Acquiring textbooks proved challenging due to their unavailability in the market or bookstores. This encompassed a teachers' handbook on the implementation of the CBC, sanctioned pupil course materials including literary activity books, Kenya sign language texts, creative activities books, approved hygiene and nutrition activity resources, play materials, and the absence of permanent classrooms for lower classes, necessitating frequent movement. In certain regions, education at these levels occurs beneath a tree or shadow, which is inconvenient. The survey revealed that certain schools were entirely devoid of educational resources.

Kenya is one of the countries that have had difficulties in guaranteeing affordable and easily obtainable textbooks for all students in schools. To tackle the issue, the Kenyan government and the World Bank joined forces under the Secondary Education Quality Improvement Project. The implemented improvements led to an approximate 65% decrease in the costs associated with textbooks for students in grades 7 to 12, including both the price of the books and the fees involved in distributing them. Over the course of one year, the Kenyan government managed to save a significant amount of money, specifically US\$138 million, solely on textbooks for students in grades 7 to 12. In addition, the books began to be supplied to schools promptly. The program achieved all of this with a relatively small expenditure of around US \$13 million. In 2017, a noteworthy achievement was reached in Kenya when every student in Form one was provided with a gratis textbook. This effort generated tremendous enthusiasm among the children, parents, teachers, school administration boards, and government authorities.

A worldwide study conducted in 15 African nations, such as South Africa, Kenya, Lesotho, Swaziland, Namibia, Malawi, and Uganda, evaluated the mathematical and reading abilities of Grade 6 children, who have an average age of 12, along with their teachers. The study can be accessed at the following URL: <https://www.sacmeq.org/>. Research undertaken by economist Nic Spaull from Stellenbosch University reveals that 27% of Grade six children in South Africa demonstrate functional illiteracy, while 40% exhibit functional innumeracy. The statistics exhibited substantial variation throughout South Africa's nine provinces. Limpopo, which is the focal point of the textbook issue and legal actions, exhibited the lowest reading test scores. Just 49% of Grade 6 learners in the province were deemed to possess functional illiteracy skills.

Spaull's research assessed the influence of textbook accessibility on academic performance. He discovered that students who have their own reading textbooks, or share with no more than one peer, "achieve significantly better results" than those who must share textbooks with multiple classmates. Consequently, according to this literature, it is imperative to forecast the necessary textbooks for the execution of CBC at Senior Secondary School in 2026.

Miller and Seller (1990) contend that instructional materials are essential components of the learning process, and the effective execution of the intended program is unattainable without them. The authors also observe that educational materials furnish information and opportunity for pupils to use their acquired knowledge. Wilkins (1974) agrees with Miller and Seller (1990) that teachers lacking necessary resources and facilities may fail to attain their educational objectives for students. Moreover, he asserts

that this implies children cannot be taught using the most effective methods. Miller and Seller (1990) propose that in contexts of limited resources and facilities, Teachers should demonstrate creativity by devising and offering alternate solutions utilizing locally available materials. This simulation is vital for the current research as it emulates the fundamental prerequisites for executing the CBC in Senior Secondary Schools by 2026.

Mundia (2017) asserts that instructional resources are essential in the classroom, functioning as the primary means of communication that enhances effective teaching and learning. Adedapo (2006) asserts that these activities effectively engage and maintain learners' attention, enabling them to uncover and demonstrate their own skills and abilities. Therefore, it is essential to have instructional resources available during the teaching and learning process. Effectively employing instructional resources and digital technologies is crucial for ensuring sustained development for pupils. Gayne (2010) posits that Teachers can achieve this by adeptly incorporating attention, motivation, and initial observations at the commencement of a teaching session. This involves utilizing appropriate approaches and strategies during the teaching session to engage the learners' attention. The instructor should deliver a succinct summary, evaluate, and critique the course.

Waweru's (2018) research on the impact of teacher preparedness on the implementation of the CBC in public primary schools in Nyandarua North Sub-County, Kenya, revealed that 98.8 percent of teachers were insufficiently equipped to execute the CBC in the newly introduced subjects. These topics lacked instructional materials, in contrast to traditional courses like as mathematics and languages, which had an abundant supply of

resources. The majority of Teachers surveyed in this study recognized the necessity for considerable assistance in creating evaluation rubrics specifically designed to assess students' ability in doing particular tasks. Waweru advocated the dissemination of CBC instructional materials to schools to enhance the teaching process.

Hanushek, Kain, and Rivkin (2008) conducted a study investigating the influence of schools, Teachers, and academic achievement. This study examined the impact of instructional materials on learners by assessing both the amount and quality of these resources. The research indicated that the quality of teaching and learning resources influenced students' academic achievement. Schools with a higher ratio of teaching and learning materials per student attained superior outcomes compared to those with a lower ratio. This study examined the educational resources provided in newly constructed secondary schools and evaluated their impact on academic performance in Kenya.

Sifuna and Obonyo (2019) indicated that educational print and digital resources had not been disseminated to schools, and in conjunction with the substandard quality of learner's books available in bookstores, most schools were deficient in instructor guides and handbooks. The evaluations offered rubrics contained ambiguous standards, complicating the assignment process for learners. The report highlighted that the rushed adoption of the curriculum, which burdened writers and publishing firms, led to the production of unrevised or poorly produced books.

An evaluation by Sakwa (2019) in the standard digital indicated that the implementation of CBC necessitated government provision of resources, which were insufficient. Consequently, the majority of supplementary teaching materials were expected to be

supplied by parents, many of whom lack the financial means, thereby creating significant obstacles for learners whose parents are unable to contribute. Muasya and Waweru (2019) discovered in their study on Teachers and resources for successful implementation that the majority of instructors expressed low agreement with the sufficiency of government funding for schools to effectively execute the CBC. The investigation of their study revealed that the government funding allocated to schools was insufficient for the effective implementation of the Competency Based Curriculum (CBC). The program was hastily executed, and the existing infrastructure in schools was inadequate for its successful implementation. The teaching and learning materials in the schools were insufficient relative to the number of students, and there were no laboratories, among other deficiencies.

In the Makunja (2016) study in Tanzania, the head teachers, academic teachers, teachers and learners recommended that the state should guarantee provision of sufficient learning and teaching resources are allocated and supplied to all public secondary schools. The respondents stated that the provision of quality education is contingent on accessibility of quality teaching and 59 learning materials whose responsibility is the government and other education stakeholders.

According to Mugambi (2006), the acute scarcity of instructional resources is one of the factors that could be responsible for varying intra- and inter-school/academic achievement. He asserts that this constraint prevents educational systems from responding more completely to new demands. According to him, educational systems will require tangible resources that can be purchased in order to address the education

crisis. They will require a greater proportion of the nation's workforce, not only to continue the current educational endeavors, but also to enhance their efficiency, productivity, and quality. Additionally, they will require additional learning materials, apparatus, and buildings. Therefore, in order to ensure the successful implementation of CBC at the Senior Secondary level in 2026, it is imperative to have an adequate supply of textbooks. Consequently, the objective of this research is to estimate the required amount of textbooks.

2.7.Free Secondary Education (FSE) capitation requirement for the implementation of the CBC in schools.

Undoubtedly, investments in education are a crucial element of a country's growth plan. Education is identified as a crucial means in the Vision 2030's social pillar to advance Kenya's transformation into a middle-income economy. Enhancements in both the amount and standard of educational offerings have been linked to several advantages, such as increased productivity, decreased poverty and income inequality, improved health, and economic growth (Lockheed, Verspoor and companions 1991). Based on this information, governments in poor countries persist in allocating a significant portion of their overall expenditure to the education sector (UNDP 1999). The Free Secondary Education policy was implemented in Kenya in 2008 with the objective of ensuring that secondary education is financially accessible to all (MOE, 2007). Furthermore, the 2010 Constitution has enshrined the provision of free and mandatory Basic Education as a fundamental entitlement for every child in Kenya (MOE, 2012). The Free Secondary Education policy aimed to ensure equitable access to secondary education for all

individuals of secondary school-going age, irrespective of their socioeconomic status, gender, ethnicity, and physical or mental disabilities (Ngeno, 2015). The primary goals of Free Secondary Education were to increase the availability of secondary education, better its quality, ensure fairness and inclusivity, and promote equal representation of both genders in the provision of secondary school education (MOE, 2007). Increased financial support was anticipated to enhance access and facilitate the transition of students from primary to secondary education under the Free Secondary Education funding. It was also expected to provide sufficient resources to students, with the hope of improving academic performance. According to Coombs (1968), quality of education refers to the education being provided that aligns with the present requirements, values, and future potential of a specific country. Therefore, the Free Secondary Education policy was implemented with the aim of facilitating the smooth progression of students from elementary schools to secondary schools, enhancing the standard of secondary education, and minimizing inefficiency. The inaugural cohort of students who were recipients of the Free Secondary Education policy completed their studies in 2011 (Ngeno & Simatwa, 2015).

Multiple research have been conducted on Free Secondary Education. Gogo (2003) conducted a study to analyze the effects of implementing a cost sharing plan on the accessibility, fairness, and quality of secondary education in Kenya. The study design employed was correlational. The study employed the stratified random sampling technique to obtain the sample. The participants in the study consisted of head teachers and 12 pupils chosen from 32 out of 46 schools (69.6%) that were sampled, together with the District Education Office of Rachuonyo District. A grand total of 417 participants

were utilized. A questionnaire was employed as the primary tool for gathering data. Furthermore, supplementary information was obtained by examining papers sourced from educational institutions, District Education Offices, and libraries. The data analysis involved the utilization of descriptive statistics, time trends, and multiple linear regression techniques. The independent variables were evaluated for statistical significance using a two-tailed test with a confidence level of 0.05. The survey revealed that the district's enrolment rate remained low due to the parents' struggle in procuring the necessary fees. Nevertheless, following the adoption of free secondary education, it is important to assess the current state of access to education.

Chabari (2010) conducted a study on the difficulties encountered during the implementation of Free Secondary Education in public secondary schools in Kangundo District, Kenya. The study's findings revealed that the implementation of the Free Secondary Education policy resulted in a consistent rise in the average student population in schools, thereby causing classrooms to become overcrowded. Additionally, the analysis indicated that the financial resources provided by the government were insufficient and were consistently delayed in their disbursement. The purpose of the current study is to forecast the necessary funding for Free Secondary capitation in order to implement the CBC in Senior Secondary Schools in Kenya by the year 2026.

Ngeno and Simatwa (2015) used Kericho County as a case study to investigate how Kenya's free secondary education policy affected dropout rates. The sample for this study consisted of 4,457 individuals, including 2011 form IV students, directors of studies, principals, and sub county quality assurance and standard officers. Data was collected

using a variety of methods, including questionnaires, interview schedules, focus group discussion guides, and document analysis guides. We used descriptive and inferential statistics, as well as cohort analysis, to examine the quantitative data. New themes and subthemes emerged from the transcription and analysis of qualitative data. Following are the form-to-form transitions for the three cohorts (form I, II, III, and IV) from 2004 to 2007: 9103, 9333, 9217, and 9281 for the 2005 cohort, 9434, 9434, 9329, and 9237 for the 2006 cohort, and 10516 and 10637, respectively, for the 2007 cohort. Overall, there was a general fall when pupils transitioned from form one to form four for the 2004 cohort, therefore the fluctuations might be explained by repetitions and dropouts. This pattern raised red flags since, according to Ngeno and Simatwa (2015), the goal of the Free Secondary Education policy was to boost and maintain enrollment. To determine if the goal of the Free Secondary Education policy, which was to improve students' transition from primary to secondary school, had been accomplished, it was reasonable to look at Mbita and Suba Sub-counties to see if the same pattern applied outside of Kericho. Ngeno and Simatwa (2015) also looked at form-to-form transition rates, which goes against the goals of the MOE's primary-to-secondary transition initiatives. After that, it was determined whether the goal of the Free Secondary Education policy, which was to improve the standard of secondary education, had been accomplished by this study.

Every kid in Kenya has the constitutional right to a free and mandatory elementary education (<http://www.kenyalaw.org>). The Basic Education Act of 2013 states that all parents, whether they are Kenyan or not, are obligated to enroll their children in elementary and secondary schools within the country.

An extra two years of high school are part of the new system that will supposedly be completely operational in 2026. The current length of time spent learning in secondary school is four years. The curriculum reform isn't the only thing the Kenyan MOE is dealing with; they're also trying to figure out how to pay for secondary school tuition-free (<http://www.education.go.ke>). This was a central promise of the two major candidates running for president in the 2017 election, which ended with President Uhuru Kenyatta taking the oath of office on November 28, 2017.

Wafubwa (2021) examines the challenges of teaching and assessing 21st Century competencies in Africa, specifically regarding Kenya's new Curriculum of Basic Education. The literature review acknowledges that the demands of contemporary society require an educational reorientation towards the attainment of 21st century skills, which Kenya must embrace. Consequently, the implementation of the CBC is crucial for fostering the essential skills expected of global citizens in the 21st century. The study determined that the assessment framework proposed by the CBC is inadequate and fails to provide clear guidance to Teachers, hence undermining the operationalization of the CBC. The funding for the CBC, whether derived from tuition fees for free basic education, is insufficient, and delays in distribution will elucidate the challenges hindering CBC implementation, particularly at the Junior Secondary School level. Teachers additionally indicate deficiencies in staffing and significant pedagogical obstacles regarding the proper implementation of the CBC programs. The significant deficiencies in the execution process accurately mirror the shortcomings of curricular theory and practice in Kenya, which have been exacerbated by a swift political impetus

favoring a radical implementation strategy rather than a progressive model, resulting in the observed gaps.

Subery (2022) examined the impact of school-based factors on the implementation of the CBC in public primary schools within Kajiado North Sub-County, Kenya. The study employed a survey design and concentrated on 63 public primary schools, involving 63 head teachers, 516 teachers, and 3,402 students from Grades 4 and 5. The findings revealed that factors within the school environment encompassed the leadership styles of head teachers, the availability of infrastructure, and the management of government-disbursed funds allocated for the operationalization of the CBC. It is thus wise to formulate an estimation of the financial resources required for the execution of CBC at the Senior Secondary level in 2026.

Mackatiani and Fierer (2023) discuss the implementation of the CBC in Junior Secondary Schools in Kenya, highlighting the various challenges that hinder its effective execution. These challenges include insufficient government funding for the CBC and the delayed disbursement of the limited funds allocated to Junior Secondary Schools. There is a notable deficiency in funding allocated for infrastructural development, particularly in light of the significant infrastructural gaps, excessive enrollment in Junior Secondary School classrooms, and the absence of science and ICT laboratories. The absence of comprehensive curricular materials is a prevalent issue within government-sponsored Junior Secondary Schools in the public education system. There exist deficiencies in manpower, as well as a notable absence of the essential knowledge, skills, and attitudes required for the effective implementation of JSS curricula.

The 2017 Economic Survey reports that out of 8,592 secondary schools in Kenya, 1,350 are private and the rest are public. Total enrollment in secondary schools in Kenya increased to 2.72 million in 2016 from 2.56 million in 2015, according to a survey by the Kenya National Bureau of Statistics (KNBS 2016). It is necessary to prepare ahead of time because the enrollment is anticipated to increase soon. The annual budget for free secondary education capitation is 22,244 shillings per student. The following shillings go to various vote heads: 4,144 for learning materials and exams, 5,000 for maintenance and improvement, 9,400 for other vote heads (local travel and transport, administration, electricity, personnel emolument), 1,500 for activity fees, 2,000 for medical and insurance, 200 for SMASSE (KIPRA 2018). Therefore, in order to prepare ahead of time, it is prudent to predict the financing requirement for free day secondary schools in Kenya for the year 2026.

2.8.Gaps in Literature

The study aimed to create a model that predicts the number of students enrolling and the resources needed for the adoption of the CBC in Senior Secondary Schools in Kenya in 2026. The study aimed to forecast the future enrollment trends of the grade 1 2017 CBC cohort in Senior Secondary Schools in 2026. It involved modeling projections for teacher, classroom, and textbook requirements, as well as projections for the Free Secondary Education (FSE) capitation requirements for the implementation of the CBC in Senior Secondary Schools in Kenya in 2026. This study aims to address the gap left by previous studies, which failed to anticipate the specific requirements for implementing the CBC at Senior Secondary Schools in the year 2026.

CHAPTER THREE

RESEARCH METHODOLOGY

3.0. Introduction

This chapter dealt with the research design, the area of study, the target population, the sample size and sampling techniques, research instruments, reliability and validity of the research instruments, data collection procedures and data analysis.

3.1. Research Design

The research utilized a predictive design methodology. In predictive research design, the investigator must explicitly state that the objective of the investigation is to ascertain the predictive capacity of a specific variable (Pandita, 2012). Consequently, this design necessitates that the researcher possesses both a predictor variable and a criterion variable. This design holds considerable importance in research endeavors focused on predicting a specific phenomenon. Predictive research design focuses on predicting future outcomes or trends based on prevailing data and patterns. It aims to anticipate what will happen rather than simply describing what has already occurred. This approach utilises various techniques, including statistical modelling and machine learning, to identify relationships between variables and project future events. This research design counts on gathering relevant data, which can include historical data , survey results , or other types of information that can be used to identify patterns. Reseaechers construct predictive models using statistical techniques. These models aim to capture the relationships between variables and make predictions based on new data.

A minimum of four general types of basic information is necessary in order to predict future school attendance. The first category relates to the count of individuals who are of school age, the second category relates to the count of students who are currently enrolled, the third category relates to different rates and ratios derived from the first two types of data, and the fourth category relates to matters of administrative policy that have an impact on education as a whole and specifically on student enrollment (Mehta, 1994). The first stage in educational planning is to forecast the future magnitude of the school-age population enrolled at whatever educational level. This is because it acts as the basis for forecasting the future quantity of schools, classrooms, teachers, textbooks, money, and other resources. The objective of the projection is to develop a fundamental foundation for future reference. The relationship between demographic challenges and the growth of education is complex and interconnected in multiple ways. There are substantial causal relationships in both directions. The relationship between population dynamics and educational development is reciprocal. Population dynamics directly impact the progress of education, while educational development influences population increase and distribution (Ahmed, 2000). Therefore, these projections are necessary in this research to forecast future enrolment and therefore predict the required number of teachers, textbooks, classrooms, and finances for subsidized day secondary education for the implementation of the CBC at Senior Secondary schools in Kenya by 2026.

3.2. The Location of the Study

The study was carried out in Kenya. Vihiga County was selected as the accessible study population after a random sampling of four Counties, that is, Nairobi, Mombasa, Vihiga

and Kiambu Counties. These four counties were purposely selected for having the highest population in the country. Vihiga County is one of the 47 counties that were created when a new national constitution was promulgated in Kenya on 27th August 2010. In the 2019 Census Report, the county had a total population of 554,622 with a population density of 1,045 people per square kilometre. Nairobi County is leading with a population of 6,247 people per square kilometre followed closely by Mombasa County with 5,495 people per square kilometre and Vihiga comes third. According to the Vihiga County Integrated Development Plan 2018-2022, the high population density has negatively impacted on the available resources including land, forests and wetlands. This therefore means that the educational resources are also overstretched, and thus careful planning is needed in the implementation of CBC. According to the KPHC 2019 report, the poverty level of the County is at 39 percent against the national's at 45 percent. This means less contribution of stakeholders to provision of teaching /learning resources in the implementation of CBC. Despite there being Free Primary Education (FPE) and Subsidized Secondary Education, high poverty may also negatively affect enrolment if planning is not well done.

The County borders Kakamega County to the North, Nandi County to the East, Kisumu County to the South and Siaya County to the West. Vihiga County has an annual average rainfall of between 1800mm and 2000mm with an average temperature of 24⁰c (Republic of Kenya, 2019). The County has 150 secondary schools with an enrolment of 39,413 students and the primary schools are 457 in total (County Government of Vihiga, 2018).

3.3. Target Population

This study targeted all primary schools because they released pupils for Junior Secondary Schools who will there after transit to Senior Secondary Schools. Secondary schools were also targeted in this study as they will receive students for Junior and Senior Secondary education under CBC. The population of the study was, MoE County Director of Education from the sampled county, 457 head teachers and 161 principals of the sampled schools.

This study targeted all primary schools which released pupils to Junior Secondary and eventually Senior Secondary Schools education under the new curriculum.

3.4 Sampling Techniques and Sample Size

Sampling involves making of conclusions about an entire population using a subset of the population (Orodho 2004).

The sample consisted of all 161 principals and all 457 head teachers adopted using a census approach. The schools were categorised into various categories basing on their characteristics. That is boarding girls, boys or mixed, day girls, boys or mixed, both day and boarding boys, girls or mixed.

3.6 Research Instruments

Questionnaires, document analysis and direct observation were the main research instruments determined and tied to the study methodology. These methods were used to get data from key respondents in order to model projections of the enrolment and requirements for Senior Secondary Schools for the implementation of CBC in Kenya.

3.6.1. Questionnaire

There were two questionnaires for the head teachers of primary schools and the principals of secondary schools. Questionnaire for Primary School heads sought information on total enrolment from 2017 to 2021 in primary schools. Questionnaire for Secondary school principals sought information on total enrolment 2017-2021 in secondary schools.

Data from this enrolment patterns were then used to come up with projections for the enrolment at Senior Secondary School in 2026. This was further used in the projection of the targeted requirements for the implementation of CBC at the Senior Secondary School in the year 2026.

3.6.2. Document Analysis

Document analysis is a type of qualitative research where the researcher interprets papers to provide insight and understanding on a certain evaluation issue (Bowen, 2009).

The NEMIS output software was analysed to get information on enrolment.

3.6.3. Observation

An observation schedule was used to get the available number of selected infrastructures such as classrooms, toilets, and laboratories in schools. Observation schedules are a systematic method for collecting observational data. This provided predefined categories and instructions for recording observations. This allowed the researcher time to observe count and rate the various infrastructure such as library, classrooms, dining hall, toilets among others.

3.7 Validity of research instruments

Validity pertains to the precision and significance of inferences derived from the findings of a study, as stated by Mugenda & Mugenda (1999). It pertains to the degree to which the conclusions drawn from data analysis precisely depict the events under investigation.

Validity refers to the extent to which the data acquired in the study accurately represents the factors that the study aims to investigate. The researcher established the content validity of the instruments by engaging in talks with university supervisors, department lecturers, and coworkers to evaluate the items included in the instruments. In addition, the study enlisted the assistance of independent educational researchers and 35 specialists in instrumentation to evaluate the accuracy and reliability of the data collection instruments. Subsequently, the researcher utilized the provided guidance to make necessary modifications and rectifications to the instruments in order to mitigate any potential validity limitations.

3.8 Reliability of Research Instruments

The instruments' reliability was evaluated through the use of the test-retest method. The capacity to reliably generate the same outcomes across time is what Orodho (2005) calls instrument dependability. If it can reliably measure the same variable under the same conditions for a long time, then the instrument is trustworthy. In order to measure the consistency of a standardized exam, statisticians often use a correlation coefficient, which ranges from 0.00 to 1.00 and shows the strength of the link. In an ideal world, a correlation coefficient of 1.00 would imply 100% reliability, whereas a value of 0.00 would indicate complete unreliability. A preliminary study was conducted in five schools

within a certain sub-county to enhance the reliability of the instruments. Repeated administrations to the same sample of people allow researchers to gauge the reliability of a study tool (Mugenda & Mugenda, 2003). A week after the first administration, the second one happened. To check for consistency and reliability, we linked the two tests' scores using Pearson's product moment correlation. At the 0.05 level of significance, the Pearson's correlation coefficient for the two sets of data was 0.00, indicating that the data were reliable.

3.9 Pilot study

The research instruments underwent a piloting process to ensure their standardization before to the real investigation. The pilot study was conducted at five schools located within a certain Sub-County of Vihiga County. The selected schools for piloting were excluded from the primary study. This facilitated the identification of issues that the respondents may have faced and determined if the items in the research instrument produced the necessary data for the study. The comments acquired from the pilot study aided the researcher in modifying the questionnaire to guarantee that it encompassed the investigation's aims.

3.10 Data collection

The researcher first applied for permission from the National Council of Science and Technology to conduct study, as well as from the County Commissioner and the County Education office in the Counties that were sampled. The researcher conducted site visits to the selected schools and secured authorization from the school officials to gather data.

3.11 Methods of Data Analysis

Data analysis followed the works of Gould (1993) and Thonstad (1980) in projecting the enrolment of the CBC cohorts to 2028.

Gould (1993) presents three possible pathways for projecting enrolment:

1. Calculate the average retention rate from the past data and use this to forecast the retention rate for the future year.
2. The average retention rates can be calculated by considering only the retention rates from the last two or three years, which highlights the most recent developments.
3. Weighted average is employed to apply smoothing techniques to data that exhibits seasonal variations.

The researcher preferred Gould's second method for an emphasis on recent trends in the data and largely because there is an increase in the retention from one grade to the next for all the cohorts denoting in-transfers from out of the county.

To implement this, the researcher followed Thonstad's Grade Transition Model for Primary Education which is the most used model for enrolment projections. Thonstad uses transition rates observed between the schoolyears 1975 and 1976 to demonstrate the projection of enrolment in the latter year. The researcher then generated a flow table for the study's CBC cohorts.

The academic staff required for the projected enrollment was determined by using the average teacher student ratio method (TSR) as recommended by MoE (2012) for the

secondary schools. This method considers size of the class, number of hours students receive instruction per week and number of hours taught by a teacher per week (Mehta A. 2004). To compute the number of lessons, the researcher took into consideration the Basic Education Curriculum Framework that provides for the subjects and the subjects provides for the learning outcomes, the learning outcomes provides for the number of lessons and hence the number of teachers per subject, per week, per school, per sub-county and eventually for Vihiga County. The following formulae was used: $T=E /R$

Where:

T = Number of Teachers required

E = Projected enrolment

R = Average number of students per teacher or size of average class

Projection on textbook requirement maintained the MoE policy where the textbooks/pupil ratio requires that a student /pupil be given textbooks in all subjects. At Senior Secondary School level, learners will be required to take the 12 core subjects. Learners are further provided with an opportunity to choose a minimum of one and a maximum of two subjects according to personality, abilities, interests and career choices from the list provided (KICD, 2017). With reference to these study areas in Grade 10 2026, the researcher, using the projected enrolment figure calculated the number of textbooks for the forecast years, by multiplying these ratios by the number of pupils.

The projection of infrastructure requirements was determined according to the MOE's policy, which sets the target class sizes for pre-primary, primary, and secondary levels at

30, 50, and 45 students, respectively. This study utilized the corresponding class sizes to estimate the number of classrooms needed in the county for the implementation of the CBC at the Senior Secondary School level, specifically for the predicted Grade 10 enrollment in 2026.

Using the projected enrolment for Grade 10 in the year 2026, free secondary capitation projection was calculated by basing on the current capitation of 22,444 Kenya Shillings per student. Table 3.1 presents a summary of how data will be analysed as per each objective.

Table 3. 1: Summary of data analysis procedure

Research questions	Dependent Variable	Independent Variable	Analytical method
What is the enrolment progression trends of grade 1 2017 CBC cohort into Senior secondary schools in 2026 in Kenya?	Projected enrolment of Grade 10 cohort in 2026 (Ratio scale)	Enrolment progression trends of grade 1 2017 cohort (Ratio scale)	Descriptive statistics Thonstad's Grade Transition Model for Primary Education
What is the projection on teacher requirements for the implementation of CBC in Senior Secondary Schools in 2026 in Kenya?	Teacher projection for the implementation of CBC (Ratio scale)	Number of teachers handling grade 3 in 2019. Projected enrolment of Grade 10 2026 cohort. (Ratio scale)	Descriptive statistics Method based on number of pupils per class and pupil /teacher ratio. $T = \frac{E}{R}$
What is the projection of classroom requirements for the implementation of CBC in Senior Secondary schools in 2026 in Kenya?	Classrooms projection for the implementation of CBC (Ratio scale)	Number of classrooms available Projected enrolment of Grade 10 2026 cohort. (Ratio scale)	Total projected enrolment for the year divided by class size, In this case 45 learners per class.
What is the projection of textbook requirements for the implementation of CBC in Senior secondary Schools in 2026 in Kenya?	Textbooks projection for the implementation of CBC in Grade 10 (Ratio scale)	Textbooks availability Projected enrolment of Grade 10 2026 cohort. (Ratio scale)	Textbooks/student ratio method. A ratio of 1:1 was considered.

<p>What is the projection of Free Secondary Education (FSE) capitation requirements for the implementation of CBC in Senior secondary Schools in 2026 in Kenya?</p>	<p>FSE capitation projection for the implementation of CBC in Grade 10 (Ratio scale)</p>	<p>Current Subsidized Secondary School Education funding per student. Projected enrolment of Grade 10 2026 cohort. (Ratio Scale)</p>	<p>Total projected enrolment (N) multiplied by capitation per student (C) (Kshs. 22,444.00) =N*C</p>
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CHAPTER FOUR

DATA ANALYSIS, PRESENTATION AND DISCUSSION

4.1 Introduction

Results and discussion of the findings of the study on Projection Models for Selected Requirements in the Implementation of Competency Based Curriculum in Senior Secondary Schools in Kenya are discussed in this chapter. They are based on the objectives of the study which were to; project the enrolment progression trends of grade 1 2017 CBC cohort into Senior Secondary Schools in 2026 in Kenya, model projections of teacher requirements for the implementation of the CBC in Senior Secondary Schools in Kenya, model projections of selected infrastructure requirements for the implementation of the CBC in Senior Secondary Schools in Kenya, model projections of textbook requirements for the implementation of the CBC in Senior Secondary Schools in Kenya, model projections on Subsidised Secondary Education capitation requirements for the implementation of the CBC in Senior Secondary Schools in 2026 in Kenya.

4.2 Description of data

The study collected five years (2017-2021) of historical data on enrolments, repetitions, dropouts in-transfers, out-transfers, and deaths among the CBC cohorts. The data were absolute showing increasing enrolments for each cohort running to 2021. This rendered data on repetitions, dropouts in-transfers, out-transfers, and deaths redundant as applying those on the absolute data would have yielded substantially different enrolment numbers other than those given by the Vihiga County statistics office.

4.3 Distribution of schools in Vihiga County

Vihiga County has five sub-counties. These are Sabatia, Vihiga, Hamisi, Emuhaya and Luanda. Hamisi Sub- County has the highest number of Secondary schools while Emuhaya has the least as shown in table 4.1.

Table 4. 1: Distribution of Senior Schools per Sub-county in Vihiga County

Sub-County	Frequency	Percent	Cumulative Percent
Sabatia	36	22.36	22.36
Vihiga	30	18.63	40.99
Hamisi	52	32.30	73.29
Emuhaya	21	13.04	86.34
Luanda	22	13.66	100.00
Total	161	100.00	—

Of the 161 secondary schools in Vihiga County, mixed boys' and girls' category is at 120, while girls only schools are 23 and the least being boys' schools at 18. This shows that each gender has access to basic education as shown in Table 4.2.

Table 4. 2: Distribution of Schools by Type

School Type	Frequency	Percent	Cumulative Percent
Boys only	18	11.18	11.18
Girls only	23	14.29	25.47
Mixed boys and girls	120	74.53	100.00
Total	161	100.00	

Sub-county schools stand at 70 percent of the schools as seen in table 4.3 This points to the fact that the infrastructural improvement should be given a priority in this county.

Table 4. 3: Distribution of Schools by Category

Category	Frequency (n)	Percent (%)	Cumulative (%)
Subcounty	113	70.19	70.19
County	30	18.63	88.82
Extra County	16	9.94	98.76
National	2	1.24	100.00
Total	161	100.00	

4.4. Projected enrolment progression trends of grade 1 2017 CBC cohort into Senior Secondary Schools in 2026 in Kenya.

The first objective of the study was to project the enrolment progression trend of Grade 1 2017 CBC cohort into Senior Secondary School in 2026 in Kenya. This projected enrolment subsequently enabled the researcher to project teacher requirement, selected

infrastructure (classrooms, laboratories, and toilets), textbooks, and the funds for the subsidised secondary education.

In working out the projections, in the study, the first step was to get the proportion of the enrolment in a given year divided by the enrolment in the previous year, for example the enrolment in 2021 for the grade 1 cohort of 2017, then 2021 grade 5, was 20313. We divide this by the enrolment of the same cohort in the previous year 2020 which was 19588 and we get 1.03701 which is the transition rate from 2020 to 2021.

Since these are the last two years of the five-year historical data, we apply that transition to succeeding years in projecting enrolment in those years to 21065, 21844, 22653, 23491, 24361, 25263 and 26198 for 2022-2028 respectively. We repeat the same for the other grade 1 cohorts of 2018, 2019 and 2020.

Our second step is to project the 2021 grade 1 transition to grade 2 in 2022. To do this, we use Microsoft's Excel forecast capabilities.

The forecast uses historical time-based data to create a new worksheet that contains both a table of the historical and predicted values and a chart that expresses this data. (see, <https://support.microsoft.com/en-au/office>)

We use grade 2's vertical enrolment data in 2018, 2019, 2020, 2021 to project 18703 as the grade 2 enrolment in 2022. With the grade 1 enrolment of 17345, we get the transition rate as 1.078293456 from 18703/17345. We then use this transition rate to project the grade 1 cohort of 2021 all the way to 2028. We repeat the same procedure to project the enrolment in grade 1 in 2022 and follow suit to 2028 to generate the six cohorts that will be in secondary school in 2028.

In Table 4.4 the absolute enrolment being the data collected from the field and their projections to 2028 is presented. The greyed sections of the table show the projected enrolment.

The enrolment of CBC grade one cohort of 2017 in Vihiga County is projected to increase by 35.41% from 17990 in 2017 to 24361 in 2026. This increase is attributed to the in-transfers of learners from other Counties. Table 4.3 shows the projected grade 1 2017 CBC cohort into Senior Secondary School in 2026.

Table 4. 4: Vihiga County's Grade Transition Model for Projecting Enrolment, 2017-2026

Year	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8	Grade 9	Grade 10	
2017	17,990										
2018	18,190	18,340									
2019	18,452	18,718	18,749								
2020	18,146	18,689	19,534	19,588							
2021	17,345	18,593	19,429	19,882	20,313						
2022*			18,703	19,051	20,198	20,236	21,065				
2023*				20,167	19,520	20,998	20,597	21,844			
2024*					21,746	20,001	21,829	20,964	22,653		
2025*						23,449	20,494	22,694	21,337	23,491	
2026*							25,285	20,999	23,592	21,717	24,361

Note. Asterisks (*) indicate projected enrollment. The 2026 Grade 10 enrollment of 24,361 corresponds to the 2017 Grade 1 cohort.

Proportion 1.078293456 1.024633528 1.039595484 1.017815092
1.037012457

Step1 Get proportions for the enrolment in 2021 divided by the enrolment in 2020.

Step2 Apply the proportions to project the enrolment in t+1, i...n.

Step 3 G2 2022 projected using excel forecast 18340, 18718, 18686, 18593 to get 18703

Munyasia and Maureen (2021) in their study on Kenya's Vision 2030 and the Efficacy of CBC in Primary and secondary Schools in Siaya County, Kenya. CBC is attributed to sustainable of key education resources that calls for equally well trained teachers, without which the implementation of CBC towards attainment of quality educations towards Goal number 4 in the Sustainable Development goals would be jeopardized. The inadequate number of teachers amidst soaring students' enrolment has implications on quality of curriculum implementation. The study adopted projection model into the future and the findings were as follows: The projection of teacher recruitment in Siaya County is at 9.81 between 2024 and 2030. That teacher establishment at JSS will increase by 33.44% between 2021-2030. While teacher requirement are expected to increase by 29.63% between 2026-2030.

According to Opondo et.al (2023) on the Challenges facing implementation of CBC in Kenyan Primary Schools in Kajiado County adopted descriptive survey study design in which focused on challenges facing on implementation of CBC in Kajiado Central and Kajiado North Sub-County in which 10 schools were selected as the units of analysis. Three teachers were selected from each of the 10 selected schools totaling to 30 teacher participants in the study. The study established that teachers interviewed were sufficiently trained to teach and assess and implement CBC in primary schools in Kajiado Central and North. However, there were few teachers resulting into huge work -loads for them with implications on service delivery. The 65 enrollment of learners was huge. There were gaps in parental support. However, teachers required continuous professional development and continuous support towards ensuring effectiveness in their pedagogical dispensation.

4.5. Projection model of teacher requirements for the implementation of the CBC in Senior Secondary Schools in Kenya.

The sustainability of key educational resource requirements, such as having enough well-trained teachers, is crucial for ensuring excellent education. Without this, the implementation of the CBC in Kenya, which aims to provide quality education as envisioned in Vision 2030, may face obstacles. The International Bureau of Education (IBE) - UNESCO (2017), as referenced by Cheptoo and Ramdas (2018), discovered that instructors encountered significant resource limitations and struggled to adapt to big class sizes when implementing the new learner-centered CBC approaches. This occurred during the implementation of CBC (Competency-Based Curriculum) in Kenya in 2017. Given that the 8-4-4 system of education in secondary schools will be running alongside the 2-6-6-3 system, it is crucial to anticipate the projected enrollment and adequately plan for a sufficient number of teachers well in advance. This proactive approach is necessary to prevent a last-minute scramble that could compromise the provision of high-quality education. By the year 2027, the final group of students under the 8-4-4 education system will be completing their secondary education, allowing for the complete adoption of the CBC at both junior and senior secondary levels. Table 4.5 displays the anticipated total enrollment of students in Junior and Senior Secondary Schools in Vihiga County for the CBC program.

Table 4. 5: Vihiga County's Grade Transition Model for Projecting Enrolment, 2017-2026

Year / Category	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8	Grade 9	Grade 10	Grade 11	Grade 12
Enrolment 2017	17,990	—	—	—	2022	2023	2024	2025	2026	2027	2028	—
Enrolment 2018	18,190	18,340	—	—	—	—	—	—	—	—	—	—
Enrolment 2019	18,452	18,718	18,749	—	—	—	—	—	—	—	—	—
Enrolment 2020	18,146	18,689	19,534	19,588	—	—	—	—	—	—	—	—
Enrolment 2021	17,345	18,593	19,429	19,882	20,313	—	—	—	—	97,583	—	—
Projected 2022	17,461	18,703	19,051	20,198	20,236	21,065	—	—	—	—	—	—
Projected 2023	—	—	18,740	20,167	19,520	20,998	20,597	21,844	—	—	—	—
Projected 2024	—	—	—	20,113	21,746	20,001	21,829	20,964	22,653	—	—	—
Projected 2025	—	—	—	—	21,586	23,449	20,494	22,694	21,337	23,491	—	—
Projected 2026	—	—	—	—	—	23,167	25,285	20,999	23,592	21,717	24,361	115,954
Projected 2027	—	—	—	—	—	—	24,864	27,264	21,516	24,527	22,104	25,263

Projected 2028	—	—	—	—	—	—	—	26,685	29,399	22,046	25,498	22,498
Teachers Required (2028)	—	—	—	—	—	—	—	—	—	—	—	3,384.98
Proportion	1.0732	1.0783	1.0246	1.0396	1.0178	1.0370	—	—	—	—	—	—
Proportion	1.073248955	1.078293456	1.024633528	1.039595484	1.017815092	1.037012457						

Step1 Get proportions for the enrolment in 2021 divided by the enrolment in 2020.

Step2 Apply the proportions to project the enrolment in t+1, i...n.

step 3 G2 2022 projected using excel forecast 18340, 18718, 18686, 18593 to get 18703

The estimated enrolment of Junior Secondary School students in Vihiga County is expected to rise from 21,844 in 2023 to 23,491 by 2025. The increment is 7.54%. The estimated enrolment in senior secondary school is expected to rise from 24,361 in 2026 to 26,198 in 2028. This is a 7.54% growth.

The total number of students enrolled in Junior and Senior Secondary School will be 152,324. The rise in school enrolment should be accompanied by a corresponding increase in the allocation of teaching resources. With 152324 learners and a PTR of 45:1, we will need $152324/45=3384.9778$ rounded off to 3385 teachers. At now, there are 2513 teachers available to teach at secondary schools in the county. However, there is a shortage of 872 instructors to adequately instruct the predicted 152324 students. This calculation assumes that the county will retain its current teaching staff employed by the instructors Service Commission. The current deficit stands at 26 percent. The current number of teachers in secondary schools in Vihiga County is 2513, which accounts for 74% of the total number of teachers needed by 2028. Nevertheless, it is imperative to establish mechanisms to tackle the existing scarcity of teachers in order to prevent any adverse impact on the educational standards of both the 8-4-4 and the 2-6-6-3 school systems. The Teachers' Service Commission should deploy primary school teachers who meet the qualifications for teaching in secondary schools in a systematic manner, in order to address the teacher shortage and manage the transition crisis in Junior Secondary Schools. It is advisable to carry out this deployment in phases and also recruit additional intern teachers on a temporary basis.

According to Maina (2018), the student-teacher ratio at newly established secondary schools was seen to be excessively high, which hinders effective teaching and learning.

The ability of teachers to supervise individual learners was constrained, and it was seen that schools with a significantly high student-teacher ratio exhibited low performance due to the overwhelming amount of learners that teachers had to handle.

This aligns with a study by Sitenei (2020) that examined the impact of school-based factors on the implementation of CBC in primary schools within Kibera Sub-County, Kenya. The results indicated that a significant proportion of Teachers (81.6%) participated in a one-week training program, whereas a smaller segment (18.4%) engaged in a two-week training course. This suggests that a significant number of Teachers had not been sufficiently trained in the new curriculum. Moreover, it has been indicated that the duration provided was insufficient for the CBC lessons, particularly in light of the substantial class sizes. Reports indicate that a significant number of schools in Kibera Sub-County are either lacking or possess insufficient materials necessary for the effective implementation of the curriculum. Moreover, the results substantiated that the public primary schools in Kibera were significantly overcrowded. The classes were so densely populated that it necessitated some students to engage in their studies from outside, particularly during practical subjects that demanded demonstration. This was, in a manner, influencing the successful execution of the curriculum. The teacher-pupil ratio of 1:80 was exceedingly high, thereby placing considerable strain on the teachers' ability to manage pupil discipline, facilitate teaching and learning, and implement effective teaching methodologies. The research underscored several obstacles impacting the execution of CBC; however, it concentrated solely on the lower primary grades. Consequently, it is essential to engage in forward-thinking as the execution of CBC at Senior School approaches.

The study conducted by Wambiya and Ogula (2023) regarding the efficacy of CBC adoption and implementation in primary schools across East African Community Countries was underpinned by a grounded theory design, alongside a document analysis technique for data collection. The research concluded that the CBC serves as a suitable educational framework for the member states of the East African Community. The excessive workload faced by teachers is a direct result of understaffing in conjunction with overcrowded classrooms. The workload of Teachers is substantial, and this challenge is exacerbated by a lack of adequate staffing. Teachers exhibit a critical disposition towards the Competency-Based Curriculum. The implications of these findings suggest that governments should consider increasing the hiring of Teachers , enhancing infrastructure, and placing greater emphasis on refresher courses and ongoing professional development for teachers, alongside continuous support mechanisms.

This is in line with what Maina (2018) discovered when she examined the data and discovered that 60% of the schools had a student-teacher ratio higher than 45 students per instructor. This exceeds the 40:1 ratio that UNESCO has recommended for developing nations, as cited in Okigbo and Osuafor (2008). According to the research, newly constructed secondary schools in Mathira Constituency have an extremely high student-teacher ratio, which makes it difficult for students to learn effectively. In wealthy nations, the student-teacher ratio is 29 according to the UN, but in 42 developing nations, it is 40. This disparity was highlighted in the study. Regardless, the majority of the schools had a high student-teacher ratio, according to the statistics.

In addition, Mogere and Mbatanu (2023) on determinants of CBC Implementation in selected Public Primary Schools in Nairobi City County, Kenya adopted descriptive

survey study design in which 35 public primary schools in the aforementioned County of Kenya were studied. The study established that implementation of CBC is impacted by teacher training and schools' leadership style and that better communication and collaboration practices bear on its effective operationalization.

According to Okigbo and Osuafor (2008), schools that have a large number of students per teacher tend to have lower academic performance because teachers are unable to effectively handle the high number of students. Akinsolu (2010) employed ANOVA and Spearman's correlation analysis to demonstrate a strong association between instructors' experience, teacher-student ratio, and students' academic achievement.

Based on the GoK (2007) report, there has been a consistent rise in student enrollment in secondary schools. The number of pupils increased from 618,500 in 1990 to 1,180,300 in 2007, representing a growth of 90.8%. The number of secondary schools experienced a significant increase from 2,557 in 1990 to 4,236 in 2007, representing a growth rate of 65.7%. Nevertheless, the number of secondary school teachers experienced a growth rate of only 58 percent, rising from 28,056 in 1990 to 44,305 in 2007. The disparity between the growth rates of teachers, schools, and student enrollment could have a detrimental impact on the quality of education in public secondary schools during the implementation of the CBC system. Masika (2020) on CBC implementation: Assessing Kenya's Readiness adopts literature review design in the study. The researcher is conscious of the fact that demographic factors of swelling class enrollment and a gap in teaching force and pedagogical gaps on the practicing teachers.

Mucheni (2021) employed mixed methods to investigate teachers' perceptions on the implementation of the CBC in Kenya. Fifty-three Teachers were sampled for the study,

and a five-point Likert Scale questionnaire was developed and employed to gather the data. The acquired data were subjected to thematic analysis. Both deductive and inductive coding methodologies were employed. The Teachers indicated that the professional development program adequately equipped them for the implementation of the CBC in classroom settings. Teachers were assessed objectively, and the majority did not meet the minimal quality levels satisfactorily. The findings indicated that although sufficient published curricular materials existed to support teaching and learning, the quality of the textbooks was lacking. The study identified a deficiency in physical and ICT infrastructure, as well as laboratories, necessary to facilitate teaching and learning activities. The limited number of teachers resulted in substantial workloads, affecting service delivery. Parental support was also lacking. Teachers expressed contentment with collegial support. However, assistance from the Teachers Service Commission and the teachers' union was inadequate. These findings have implications for stakeholder engagement aimed at enhancing CBC implementation. The Ministry of Education and associated parastatals should develop and disseminate pertinent published curricular materials, as well as organize teacher refresher programs and ongoing professional development support to improve curriculum theory and practice.

These findings align with those published by Waweru (2018), who conducted a research assessing the degree of training received by lower primary school teachers for implementing the CBC in Nyandarua North Sub-county, Kenya. The results indicated that 98.8% of the teachers lacked training to implement the curriculum, particularly in the new learning areas. In a similar vein, KNUT (2019) investigated the degree of training obtained by primary school teachers in the implementation of the CBC and found that the majority had not undergone any training about the new curriculum. Moreover,

the results align with those of Abdullahi (2020), who examined the school characteristics affecting the adoption of CBC in preschools in Garissa Sub-County, Kenya. The study determined that a majority (68%) of instructors in public schools had not participated in any training on the implementation of the new curriculum.

Furthermore, these results align with the conclusions of Molapo (2018), which aimed to determine the implementation of the new curriculum by grade 3 teachers in Limpopo primary schools in South Africa. The study indicated that most grade three instructors lacked the necessary skills and expertise for effective curriculum implementation, which impeded the process. Furthermore, the results align with the findings of Kanyonga, Maatana, and Wendit (2019), who indicated that most trainers possessed limited knowledge and skills in integrating the fundamental elements of the curriculum in Arusha, Tanzania. Furthermore, Makunja's (2016) study on the adoption of CBC to enhance the quality of secondary education in Tanzania revealed that teachers, as primary implementers, lacked the requisite knowledge and skills for effective curriculum implementation. The study recommended that the government undertake immediate and regular in-service training for teachers to equip them with the necessary competencies for efficient and effective CBC implementation. The substantial proportion of pre-primary school teachers untrained in CBC indicates that most Teachers lack the knowledge and abilities for effective curriculum implementation. Consequently, obstructing the successful execution of the Curriculum in public pre-primary schools will likewise impede its implementation at the Senior Secondary School level.

Waweru (2018) indicated that a majority (72.8%) of the teachers participated in half-day training, thereby deriving less advantage from the experience. KNUT (2019) similarly

observed that numerous teachers received insufficient training, which was conducted only once, thereby providing them with a suboptimal experience. A case study by Kisirkoi and Kamanga (2018) in Narok County revealed that all 15 instructors (100%) had not received ongoing training on the CBC, resulting in insufficient comprehension of curricular implementation. Insufficient training has been recognized as the primary factor affecting the implementation of the CBC, as noted by Handwe and Mpofu (2017), who examined teacher readiness to execute a newly established grade three curriculum in Zimbabwe. The results indicated that the implementation process failed due to insufficient training for teachers, which did not adequately meet their demands for efficient curriculum implementation. Consequently, the absence of regular in-service training on CBC will result in a deficiency of instructors possessing sufficient knowledge of the curriculum and pedagogical methods. The implementation of CBC in Senior Secondary Schools would encounter difficulties due to the limited number of teachers who have not participated in the training workshops.

Isaboke et al. (2021) assert that concerning instructors' capacity to formulate lesson plans, a majority, 18 (60.0%), of the trained individuals reported that they can independently create lesson plans that adhere to the CBC standards without assistance. Nonetheless, a majority of 31 (53.4%) teachers who had not undergone any training on CBC reported challenges in generating lesson plans that adhered to the curriculum, even receiving assistance. The majority of instructors trained in CBC exhibited superior lesson preparation skills compared to their untrained counterparts. This indicates that the training was beneficial to the Teachers . They additionally observed that the substantial quantity of pre-primary school instructors lacking training will adversely impact the implementation procedure. Jeng'ere (2017) elucidates that the production of

reflective lesson plans is essential for the proper implementation of CBC. The findings are corroborated by Waweru's (2018) study on the training of lower primary school teachers to apply the CBC in Nyandarua North Sub-county, Kenya, which revealed that 95% of these teachers found it impossible to prepare CBC lesson plans. Komba and Mwandanji (2015) examined the challenges associated with the implementation of CBC in secondary schools in Tanzania. The study's findings revealed that the majority (86%) of teachers possessed insufficient knowledge of the curriculum. Moreover, the majority (78%) of the analyzed lesson plans failed to exhibit the characteristics of a competence-based lesson plan. Consequently, all Teachers in public pre-primary institutions must get training on the formulation and implementation of lesson plans that encompass all components delineated in the curriculum designs.

This finding aligns with Mandukwini (2016), who investigated the challenges of curriculum implementation in high schools within the Mount Fletcher district, Eastern Cape. It was determined that while teachers endeavor to fulfill their roles and responsibilities to facilitate effective curriculum implementation, they still necessitate training in developing learning outcomes and assessing the achievement of established objectives at the conclusion of lessons. The results align with Kangori (2014), who examined the impact of in-service training and professional development for preschool teachers on the implementation of the scientific curriculum in Nairobi City County. The research demonstrated that teacher in-service training and professional development impacted their classroom delivery capabilities. Consequently, the County Government of Vihiga must facilitate ongoing training and professional development for pre-primary, primary, junior secondary, and senior secondary school Teachers via in-service training

programs; this initiative will enable teachers to gain expertise in managing diverse elements of the Curriculum.

Moreover, the results align with those published by Zhuwale and Shumba (2017), who examined teacher-related issues that obstructed the effective implementation of the curriculum in rural schools in Zimbabwe. The study indicated that teachers' insufficient pedagogical understanding about the integration of curricular elements into instruction was the primary obstacle impeding curriculum implementation. The report advocated for extensive training of Teachers on the curriculum. The findings corroborate those of Kanyonga, Maatana, and Wendit (2019), who investigated the implementation of core features of CBC by technical trainers in Arusha, Tanzania. The survey determined that most trainers had undergone in-service training but possessed limited comprehension of the curriculum and lacked expertise and abilities in integrating its main components. The study's findings indicate that, despite a projected shortage of teachers at the senior secondary level in 2026, both trained and untrained teachers necessitate ongoing in-service training to enhance their ability to integrate core competencies into instruction. Consequently, continual training for public school teachers on the implementation of the fundamental components of the CBC is essential.

A paper by Ndayambaje (2018) identified the problems encountered in the implementation of the Competency Based Curriculum in Rwandan schools. The report found that although all primary school teachers received training on curriculum implementation, some were opposing change. Consequently, they persisted in utilizing the outdated instructional materials and techniques. Ndayambaje (2018) identified the insufficiency of teaching-learning materials as a significant obstacle to the effective

implementation of CBC in Rwanda. This indicates that providing sufficient educational materials and ongoing teacher training to alter their perceptions of the CBC is crucial for its implementation.

A research by Makunja (2016) examined the problems encountered by teachers in the implementation of the Competency Based Curriculum in Tanzania. The study determined that Teachers encountered numerous problems that hindered the successful application of the curriculum in teaching and learning. The study identified insufficient in-service training for teachers on CBC, inadequate teaching materials, overcrowded classrooms, and low student capability as the primary obstacles to effective curriculum implementation in Tanzania. Based on the findings, the study advised that Teachers be permitted to engage in curriculum development. The report recommended that the Ministry of Education develop methods for supplying teaching materials aligned with the CBC. This indicates that the training of teachers in curriculum implementation, the provision of instructional resources, and the availability of sufficient classrooms are essential for the effective execution of the CBC as we approach its adoption at the Senior School level.

The existing teacher deficit in Kenyan elementary schools is 37,643, whilst in secondary schools it is 49,750 (Wanzala, 2019). The CBC mandates a minimum of three Teachers per class for successful execution. There is a necessity to recruit additional Teachers to efficiently execute the CBC.

Therefore, in planning for the allocation of teacher resources in Vihiga County, it is essential to acknowledge that the enrollment of students in secondary schools is anticipated to rise by 19.9% from 2023 to 2028.

4.6 Model projections of selected infrastructure requirements for the implementation of the CBC in Senior Secondary Schools in Kenya.

The third objective of the study was to model projections of selected infrastructure requirements for the implementation of the CBC in Senior Secondary Schools in Kenya. The educational resources projected in this study are laboratories, classrooms, toilets, technical facilities, boarding facilities and dining facilities.

4.6.1 Laboratories

The ministry's Registration Guidelines for Basic Education Institutions states that the new CBC-compliant schools must have room for the learning paths that the students choose. Every Senior Secondary School must provide facilities capable of providing a minimum of two educational pathways, along with all the corresponding courses within those pathways. Senior Secondary Schools that provide Stem subjects will also have the necessary additional resources to offer all four Stem tracks (MoE, 2019).

Each science discipline at both the Junior and Senior levels requires a dedicated laboratory, resulting in a total of six labs in each school. Therefore, the combined number of laboratories in both schools is 966 (161 multiplied by 6). The study surveyed principals regarding the sufficiency of laboratory facilities in their schools. The survey revealed that out of the 161 schools sampled, there are now 114 laboratories, resulting in a shortage of 852 laboratories. This aligns with the research conducted by Maina (2018), which aimed to determine if the recently created secondary schools in Mathira constituency possessed functional laboratories for science disciplines such as biology, physics, and chemistry. 20% of the principals reported having a science laboratory that

was equipped. Nevertheless, a significant majority of 80% of the principals reported that their schools lacked adequately equipped laboratories.

Maina (2018) noted that several schools had a school laboratory that consisted of a typical classroom equipped with elongated tables and seats, with a solitary faucet positioned at one end of the space. A laboratory is a crucial facility necessary for the proper teaching of science-based subjects in secondary school. Nevertheless, the National Government Constituency Development Fund had initiated the construction of laboratories at two schools. The lack of necessary physical facilities had a direct impact on the instruction of science-related topics. This study corroborates Rotich's (2004) conclusions that schools in Kenya encounter significant challenges due to inadequate physical facilities, supplies, equipment, and instruments. The observations support the findings of Hanushek, Kain, and Rivkin (2008) that a lack of essential physical resources, such as laboratory equipment, hinders learning.

This finding regarding the adequacy of secondary school science laboratories is in line with the research of Achimungu (2016) in Nigeria, who also found that secondary school chemistry curricula were negatively affected by a lack of science laboratories and inadequate school infrastructure. These findings also lend credence to the findings of two previous studies that found secondary schools in Ethiopia to be severely lacking in laboratory facilities and specialized science labs (Zengele & Alemeyahu, 2016; Daba & Anbesaw, 2016). All three research have a common thread: they all center on developing nations with inadequate infrastructure for scientific institutions. Our results are in line with those of Pareek (2019), who found that most Indian secondary schools did not have

their own scientific labs. A fully operational science laboratory was found in just one of the twenty-one schools that were examined.

The finding suggests that there is an insufficient number of science laboratories, as the required number is three, one for each of the three natural science subjects: Biology, Chemistry, and Physics. The implementation of CBC at Senior Secondary Schools would be negatively impacted by this situation, as both teachers and students will need to take turns using the same facilities for practical sessions, which will reduce efficiency.

Furthermore, it was found that the schools had no facilities whatsoever for Language and Geography labs. This is in line with the findings of a study by Mikanjuola and Sidiq (2013), who examined the fundamental resources needed to teach and learn geography in Nigerian senior secondary schools in Ekiti State. It was found that all of the schools (100%) did not have language and geography labs. The absence of language laboratories has a detrimental influence on pupils' ability to effectively acquire communication and language skills. The lack of a language laboratory hinders students from effectively acquiring language proficiency as it prevents them from comprehending the mechanics of speech production, including the role of articulators and essential components of speech development.

Furthermore, it was observed that despite the presence of 114 scientific laboratories in different schools, the available laboratory space was insufficient to accommodate each student in a given class for conducting experimental activities. This suggests that the practical learning may not achieve the desired outcome due to the high student-to-teacher ratio in the practical sessions. The absence of access to laboratories may impede effective learning for certain students, as they are unable to fully engage in experiments and make

accurate observations. Learning is optimized when learners actively engage in the process by designing experiments, conducting observations, and documenting their findings. The large student population in secondary schools has a significant impact on practical sessions, often necessitating a shift from hands-on activities to teacher-led demonstrations, when students observe in groups of 10 or more. Similarly, Mukami (2015) discovered in Kenya that the primary activities in the laboratories were teacher demonstrations, which was attributed to an unusually large number of students.

Gapfizi et al. (2017) examined the challenges faced by physics instructors in implementing the CBC in Rwanda using a survey study including 25 physics teachers from Ngoma District. The study determined that the aforementioned category of instructors encounters numerous problems in the execution of the physics curriculum within the CBC framework. The obstacles encompass a deficiency of physics laboratories and equipment, as well as an absence of pedagogical guidance for teachers' professional development in the implementation of CBC Physics curricula. Overcrowded classrooms and insufficient staffing, among other issues.

Similarly, due to the projected high numbers in Senior Secondary Schools, there is need to put up more laboratories for the success of the STEM Pathway.

4.6.2 Classrooms

According to Cheptoo and Ramdas (2020), the 8-4-4 curriculum was unable to fulfill its goal of preparing students for self-sufficiency due to a number of factors, including a lack of funding and resources, unskilled instructors, overcrowding in the classrooms, and high rates of student attrition. Our educational institutions lack the prerequisites for CBC

to function at its best: a low Pupil Teacher Ratio, adequate physical facilities, and small class sizes. It is critical to base planning and budgeting on the predicted total of 152,324 pupils enrolled in Junior Secondary School and Senior Secondary School in Vihiga County if we want to assure high-quality education. This will make it possible to distribute sufficient funds for education in accordance with the MOE-recommended standard ratios. A student-teacher ratio of 45:1 was used to calculate the required number of classrooms in relation to the predicted student body.

$$152324 / 45 = 3384.9778 \text{ classrooms}$$

Currently there are 1747 classrooms in the 161 schools sampled occasioning a deficit of $3385 - 1747 = 1638$ classrooms. There is an urgent need to build 1,638 classrooms for use in Vihiga County's junior and senior high schools in order to meet the quality education indicator of a Pupil Classroom Ratio of 45:1. The insufficiency of sufficient classrooms in secondary schools hindered the provision of high-quality instruction. This indicates that comprehensive strategies should be implemented to build an additional 1,638 classrooms in Vihiga County by the year 2028.

Sossion (2019) advocates for the implementation of small class sizes in Kenya in accordance with UNESCO's recommended criteria to facilitate customized learning. He further advocates for the establishment of facilities such as computer laboratories, workshops, libraries, and the construction of more classrooms to accommodate the increasing enrollment resulting from the government's 100% transfer program from elementary to secondary education. Given the numerous studies and stakeholders' recommendations, it is essential for the government to implement effective strategies for

securing the necessary resources to facilitate the successful execution of the Competency Based Curriculum in Kenya.

This aligns with Maina's (2018) research, which identified physical buildings as one of the insufficient physical facilities. This hindered the process of instruction and acquisition of knowledge in recently formed secondary institutions. Maina (2018) also noted that certain classrooms were taught in a temporary dining hall, especially when there were divided disciplines like Geography and History, Business Studies and Agriculture, and Biology/Physics. Sifuna and Sawamura (2009) emphasize that disparities in resource allocation exacerbate educational inequalities, particularly affecting schools in rural and marginalized areas where infrastructure development lags behind urban centers.

Nkya et al. (2021) on the implementation of CBC in Tanzania: Perceptions, Challenges, and Prospects. A study involving secondary school teachers in the Arusha Region of Tanzania employed a mixed-methods approach and a cross-sectional survey, encompassing 233 instructors, 10 secondary school heads, and 5 District Education Officers. Data were gathered using questionnaires and interview schedules. Quantitative and qualitative data were collected and evaluated using appropriate research methodologies. The study revealed that the participating teachers reported their pedagogical inability to properly execute the CBC due to inadequate orientation from refresher courses regarding its delivery. Teachers indicated insufficient curricular resources for the implementation of the CBC. The findings suggest the need for ongoing professional development for teachers, increased funding from ministries of education for CBC-related infrastructural development, recruitment of additional teachers to

address manpower shortages for effective curriculum implementation, and consistent support for teachers, along with planning and constructing infrastructure to alleviate overcrowded classrooms.

Amukowa (2020) examined the implementation of CBC in primary schools in Kenya, utilizing a descriptive survey design that involved 200 primary schools, 200 head teachers, and 4 KMTC instructors. Data were gathered utilizing questionnaires, interviews, and observations. The study determined that CBC was hastily executed prior to the establishment of all necessary logistical measures, and it was systematically planned and implemented with insufficient pedagogical training for the practicing teachers, resulting in a deficiency in their knowledge, skills, and attitudes that has hindered the effectiveness of the implementation process. Gaps in infrastructure, including ICT, physical facilities such as classrooms, computer laboratories, and ICT equipment, impede the effectiveness of physics teachers in addressing challenges during the implementation of the CBC in Rwanda. A survey study design was adopted, involving 25 physics teachers from Ngoma District. The study determined that the aforementioned category of teachers encounters numerous problems in implementing the physics curriculum within the CBC framework. The obstacles encompass the absence of physics laboratories and equipment, as well as insufficient pedagogical guidance for teachers' professional growth in delivering the CBC Physics curriculum. Overcrowded classrooms and insufficient staffing, among other issues.

Chacha et al. (2021) examined the obstacles encountered by teachers in implementing the CBC in public secondary schools in Nyamagana District, Tanzania, utilizing a mixed methods approach and a convergent parallel design with a sample of 133 participants.

Data were gathered using questionnaires and interview schedules. The findings indicated that the district was deficient in competent teachers and faced infrastructural gaps amid increasing student enrollment. Discrepancies in curricular materials were reported among the respondents. The government's diminishing financial support for the CBC is a prevalent issue.

Research by Nwosu and Nweke (2021) and Olamijulo and Sadiq (2021), among others, indicates that the presence of playgrounds in schools is favorably correlated with the successful execution of a competency-based curriculum. Institutions possessing sufficient and operational playgrounds are more inclined to execute a competency-based curriculum proficiently. Consequently, it is imperative for schools to guarantee the availability of enough and suitable playgrounds to facilitate the execution of the competency-based curriculum (Keter, 2023).

The suitability and appropriateness of classroom furniture, such as desks, seats, and tables, are positively correlated with the effective execution of a competency-based curriculum (Mungai & Rotich, 2022). Institutions equipped with suitable and enough furniture are more inclined to efficiently execute a competency-based curriculum. Consequently, it is essential for schools to secure adequate and suitable furniture resources to facilitate the execution of the competency-based curriculum.

A study by Marion (2020) aimed to investigate the obstacles faced by teachers in implementing the CBC in lower elementary schools in Laikipia East Sub-County, Kenya. Findings revealed numerous obstacles encountered by teachers throughout the implementation of the new curriculum. The Teachers indicated that the substantial classroom sizes was a significant obstacle to the execution of CBC in public elementary

schools. Furthermore, Teachers indicated that the absence of educational materials significantly hindered practical learning domains, like Music and digital literacy. The study revealed that the integration of digital literacy, problem-solving, and critical thinking competences posed significant challenges for most teachers, who said that they were still enhancing their skills in these areas. The majority of teachers cited a deficiency of materials for digital learning. The bulk of the lesson plans conformed to the requirements of the CBC and thus posed no difficulties. Nevertheless, the Teachers indicated that the CBC training was insufficiently brief and inadequate for acquiring the essential skills necessary for the implementation of CBC. The report advised the government to construct additional classrooms, supply sufficient teaching and learning resources, and implement regular teacher training. The findings from the analyzed study reveal numerous problems encountered in lower primary grades during curriculum implementation. This indicates that the CBC has not been adequately executed in lower elementary grades owing to the problems encountered by Teachers. Nonetheless, the results from lower primary grades may not be applicable to pre-primary grades; thus, it is essential to examine the obstacles encountered by Teachers in pre-primary institutions. As the nation prepares for the implementation of the Senior School curriculum, the lessons learned from lower primary and Junior School should be regarded with utmost seriousness to ensure the successful execution of the CBC at the Senior School level..

Likewise, Hipolite (2019) examined the difficulties of executing CBC at public secondary schools within Morogoro Municipality, Tanzania. The study utilized a case study design and qualitative research methodology, collecting data from 36 people through observations, interviews, and focus group discussions. The study indicated that Teachers encountered numerous obstacles that impeded the successful execution of the

Curriculum. These factors included a high student-to-teacher ratio, insufficient teaching materials, and Teachers ' inadequate comprehension of the CBC. The report advised the Ministry of Education in Tanzania to supply schools with sufficient teaching and learning resources and to offer comprehensive in-service training to all Teachers .

4.6.3 Toilets

Table 4. 6: Distribution of toilets in Vihiga County

No. of Toilets	Frequency	Percent	Cumulative Percent
3545	161	100.0	100.0
Total	161	100.0	

Projected Enrolment

Toilet Ratio of girls

$$152324/25 = *6092.96$$

As seen from Table 4.6, currently there are 3545 toilet doors in the 161 schools sampled occasioning a deficit of $6093-3545 = 2548$ toilet doors if we take the standard of 25 doors for female students and 30 for male as recommended by the MOE. Here we use the ratio for female students as that will guarantee sufficient toilet facilities for all. With the deficit of 2548 toilets, the ensuing queues will see most learners missing entire lessons, yet they will be physically present at school.

Lorris and Mejicano (2021) examine the pivotal role of infrastructure and organizational culture in the execution of competency-based curricula (CBC) and individualized pathways in undergraduate medical education. They utilized secondary data to explore competency-based medical education (CBME), an outcome-oriented developmental approach aimed at ensuring trainees' preparedness to progress through training stages and to thrive in unsupervised practice within the program's implementation. The implementation of CBME is a complex and demanding undertaking that necessitates a fundamental transformation of organizational culture and investment in suitable infrastructure. This pertains to the American Medical Association's facilitation and execution of Competency-Based Medical Education (CBME).

Kinyunyu (2020) conducted a survey study on the implementation of CBC in selected secondary schools in Mufundi District, Tanzania, involving 30 teachers. The study evaluated the CBC implementation process and the challenges encountered by teachers. Data were collected using questionnaires and interview schedules. Findings indicated that teachers are proficient in the concept of competency-based teaching, encompassing a grasp of learners' socio-economic and cultural orientations, which influence their learning processes and value systems. Teacher participants reported challenges in implementing CBC, including difficulties in enhancing students' confidence and self-esteem, as well as fostering creativity and innovation, which are integral to achieving 21st-century skills among learners. There exist infrastructural and financial deficiencies hindering the successful implementation of the CBC.

4.6.4 Library facilities

Table 4. 7: Adequacy of library facilities

Scale:0-10	Frequency	Percent	Cumulative Percent
0	12	7.45	7.45
1	1	0.62	8.07
2	17	10.56	18.63
3	6	3.73	22.36
4	14	8.70	31.06
5	49	30.43	61.49
6	39	24.22	85.71
7	10	6.21	91.93
8	12	7.45	99.38
9	1	0.62	100.00
Total	161	100.00	—

On a scale of 0-10 where 0=NOT AVAILABLE and 10=FULLY AVAILABLE 12 of the 161 principals of secondary schools in Vihiga county said their schools did not have library facilities while only one rated library facilities at 9 as seen in Table 4.7. Summary statistics suggest a mean and standard deviation of 4.73913 and 2.090221 respectively with the minimum and maximum values at 0 and 9 respectively. This suggests that by 2028, the current library facilities need to be doubled in order to cater for the entire CBC enrolment at secondary school level.

Kinyunyu (2020) conducted a survey study on the implementation of CBC in selected secondary schools in Mufundi District, Tanzania, involving 30 teachers to evaluate the CBC implementation process and the challenges encountered by Teachers . Data were

collected using questionnaires and interview schedules. Findings indicated that teachers are proficient in the philosophy of competency-based teaching, including an understanding of learners' socio-economic and cultural contexts, which influence their learning approaches and value systems. Teacher participants reported challenges in implementing CBC, including the inability to enhance students' confidence and self-esteem, as well as fostering creativity and innovation among learners, which are integral to achieving 21st-century skills. There exist infrastructural and financial deficiencies hindering the successful implementation of the CBC. Among these infrastructural deficiencies are library facilities.

Javinaitwe and Reddy (2022) examine perceptions regarding the implementation of CBC among secondary school teachers in Uganda, recognizing that CBC is a skill-oriented educational framework that is fundamentally learner-centered, emphasizing experiential learning, thereby differentiating it from the prior knowledge/content-based educational system. The respondents identified that the implementation of CBC encounters obstacles due to infrastructural deficiencies, including inadequate physical infrastructure such as classrooms, science laboratories, CT laboratories, and other ICT facilities. Additionally, there is a lack of Wi-Fi or internet connectivity, insufficient electricity in numerous schools, and overcrowded classrooms, which complicate effective classroom management and assessment, compounded by understaffing.

4.6.5 Facilities for technical subjects

On a scale of 0-10 where 0=NOT AVAILABLE and 10=FULLY AVAILABLE. 17 of the 161 principals of secondary schools in Vihiga County said their schools did not have facilities for technical subjects while only 1 rated such facilities at 10. Summary statistics

suggest a mean and standard deviation of 4.565217 and 2.069972 respectively with the minimum and maximum values at 0 and 10 respectively.

This is clearly presented in Table 4.8. This suggests that by 2028, the current facilities for technical subjects need to be more than doubled to cater for the entire CBC enrolment at secondary school level. The availability of Information and Communication Technology (ICT) laboratories is an important factor in the effective implementation of competency-based curriculum.

Table 4. 8: Adequacy of technical subject facilities.

Scale 0-10	Frequency	Percent	Cumulative Percent
0	17	10.56	10.56
2	8	4.97	15.53
3	7	4.35	19.88
4	20	12.42	32.30
5	68	42.24	74.53
6	23	14.29	88.82
7	6	3.73	92.55
8	11	6.83	99.38
10	1	0.62	100.00
Total	161	100.00	

According to the data, 17 schools were found to be without a computer lab. Schools risk falling behind in obtaining computer literacy skills—essential competencies in the CBC curriculum—if they do not have access to this resource. The integration of information and communication technology (ICT) into the classroom is impeded by the lack of access to computers and the internet. Teaching and learning with technology is more effective than the traditional classroom setting, according to a Malaysian study by Ghaviefekr and Rosdy (2015). For students to be able to access and search for content, a computer

laboratory is essential. There can be no separation between the library and the computer labs.

Kubai (2023) conducted a critical review of the challenges associated with the implementation of CBC in Nairobi City, Kenya, utilizing a survey methodology that focused on grade 1 teachers and included a sample of 120 pupils for the study. The research indicated that transition uncertainty occurred following grade 6. The absence of explicit policy rules concerning CBC implementation has hindered its efficient operationalization. The deficiencies in infrastructure, such as ICT infrastructure, are significantly lacking. These results need that policymakers in education reassess the policy framework to facilitate the effective implementation of CBC concerning materials, human resources, and infrastructure.

Oluoch and Odundo (2022) assert that the availability and suitability of ICT laboratories are positively correlated with the effective implementation of a competency-based curriculum. Institutions possessing sufficient and operational ICT resources, such as ICT laboratories, are more inclined to execute the competency-based curriculum efficiently (Oketch & Mogere, 2021). Schools must ensure they possess adequate and suitable ICT resources to facilitate the implementation of the competency-based curriculum.

Kuria (2022) discusses the correlation between schools' readiness and the successful execution of the CBC. A study examining teachers' expertise in City County, Kenya employed a survey design, acknowledging that the CBC was implemented in 2017, coinciding with Kenya's efforts towards Vision 2030, particularly in relation to Goal Number 4 on excellent education. The study was supported by Human Capital Theory. The participants comprised six teachers and one education manager, with 10 schools

surveyed. Research indicated that insufficient teacher preparation for CBC implementation and deficiencies in physical infrastructure, among other factors, had adversely affected CBC.

Owuondo (2023) regarding the disruption of Kenya's education system: Transitioning to a learner-centered paradigm from conventional time-based frameworks employs a multifaceted strategy to facilitate transformative efforts, encompassing literary criticism and appreciation. This context recognizes the significant changes that the CBC introduces, in contrast to the gradually obsolete 8:4:4 educational system, which was predominantly exam and knowledge-oriented rather than skill-focused to the extent of the CBC. The study analyzed extensive stakeholder engagement in the CBC, focusing on the acquisition of essential 21st-century skills among students. This endeavor faces numerous challenges, including teacher shortages, deficiencies in pedagogical knowledge among practicing Teachers regarding the implementation of these skills, infrastructural inadequacies such as insufficient ICT resources hindering digital literacy, and the prevalent digital illiteracy among teachers tasked with delivering this curriculum. Additionally, the absence of digital laboratories further obstructs the achievement of these vital competencies. The execution of learning areas in Junior Secondary schools, such as Integrated Science, is deficient in laboratories and other resources, as well as in trained instructional personnel, indicating shortcomings in the implementation of the CBC.

Simon (2021) regarding curriculum reform and innovation: The experiences from Kenya's CBC utilize a literature review design. In 2015, Kenya commenced the transition from the 8:4:4 education system, which was content and examination-focused, to the

skill-oriented CBC, with the inaugural cohort now in grade VIII. The operationalization of the new educational dispensation, currently undergoing transition, appears to be encountering initial difficulties typical of any new educational system in Kenya, such as infrastructural gaps, insufficiently pedagogically prepared teachers essential for the implementation process, and a lack of curricular materials, including published books and ICT infrastructure. These issues hinder the achievement of the objectives of the CBC educational system.

Nsengimana (2020) on implementation of CBC in Rwanda: Challenges and Opportunities adopted a survey design and is of cognizance that by 2015, Rwanda transited from knowledge based educational system to skill-based CBC. Data were collected through focused group discussions, surveys and school visits. Findings indicated that the CBC was acknowledged as a new educational dispensation. However, the new system of education faces multiple challenges during its implementation including inadequate teaching/learning materials, inadequate teaching staff, swollen classrooms, inadequate physical and ICT infrastructure, lack of science laboratories. That prospects include hiring more teachers, constructing more classroom, teachers' continuous professional development towards alignment with the CBC pedagogical demands, ministries of education to provide curricular materials towards effectiveness of operationalization of the CBC.

Without access to computers in the classroom, pupils are left in the dark about modern technology, and the goal of secondary school students acquiring computer literacy skills will remain a distant dream. Raising secondary school pupils' proficiency in computer science should be an official priority for the MOE.

4.6.6 Boarding facilities

On a scale of 0-10 where 0=NOT AVAILABLE and 10=FULLY AVAILABLE the mean for the 37 schools with boarding facilities in Vihiga County is 6.162162 with standard deviation of 115 of 1.848626. This suggests that by 2028, the current boarding facilities will need an improvement of up to 43.98% to cater for the entire CBC enrolment in boarding schools ($6.162162/11*100=56.019655$; $100-56.019655= 43.980345$).

Omariba (2022) examines the challenges encountered by parents in the implementation of the CBC in Kenyan primary schools, employing literary criticism and appreciation. The author acknowledges that the success of any educational innovation is contingent upon stakeholder involvement, particularly parental engagement in the operationalization of CBC. This is critical as a fundamental necessity of the program. The research was underpinned by Epstein's Theory of Overlapping Spheres of Influence. The study identified challenges in the implementation of CBC in Kenya, including insufficient curricular materials, inadequately trained teachers affecting curriculum effectiveness, infrastructural deficiencies in physical resources, software, and ICT devices, all of which may adversely impact the objectives of CBC.

Table 4. 9: Adequacy of boarding facilities

Scale	Freq.	Percent	Cum.
0	1	2.70	2.70
4	1	2.70	5.41
5	6	16.22	21.62

6	12	32.43	54.05
7	8	21.62	75.68
8	8	21.62	97.30
9	1	2.70	100.00

Total 37 100.00

Subery (2022) examined the impact of school-based determinants on the implementation of the CBC in public primary schools within Kajiado North Sub-County, Kenya, utilizing a survey methodology that encompassed 63 public primary schools, 63 head teachers, 516 instructors, and 3,402 students in Grades 4 and 5. Findings revealed that school-based determinants encompassed head teachers' leadership styles, infrastructure availability, and the management of government-disbursed monies for CBC implementation. Ondieki and Masese (2021) assert that the presence of play materials and equipment in schools positively impacts the effective execution of a competency-based curriculum. The insufficiency of play materials and equipment obstructs the proper execution of a competency-based curriculum in schools, as play is a crucial element of CBC. Consequently, schools equipped with adequate and suitable play materials and equipment are more inclined to execute the competency-based curriculum efficiently. Schools must provide a diverse array of play materials and equipment, including blocks, puzzles, and sensory resources, to facilitate the execution of the competency-based curriculum.

4.6.7 Dining facilities

Table 4. 10: Adequacy of dining facilities

0-10			
scale:	Freq.	Percent	Cum.
0	106	65.84	65.84
3	2	1.24	67.08
4	5	3.11	70.19
5	11	6.83	77.02
6	17	10.56	87.58
7	14	8.70	96.27
8	5	3.11	99.38
9	1	0.62	100.00
Total	161	100.00	

On a scale of 0-10 where 0=NOT AVAILABLE and 10=FULLY AVAILABLE. 106 of the 161 principals of secondary schools in Vihiga County said their schools did not have dining facilities while only 1 rated such facilities at 9. Summary statistics suggest a mean and standard deviation of 2.049689 and 2.953391 respectively with the minimum and maximum values at 0 and 9 respectively. This suggest that by 2028, the current dining facilities need an improvement of up to 81.37% to cater for the entire CBC enrolment at secondary school level ($2.049689/11*100=18.633536$; $100-18.633536= 81.366464$).

Javinaitwe and Reddy (2022) acknowledge that perceptions regarding the implementation of CBC among secondary school teachers in Uganda recognize CBC as a skill-oriented educational framework that is entirely learner-centered, emphasizing experiential learning, thereby differentiating it from the prior knowledge/content-based educational system. The respondents identified that the implementation of the CBC is hindered by infrastructural deficiencies, including inadequate physical facilities such as classrooms, science laboratories, and ICT laboratories, as well as insufficient ICT infrastructure, including the absence of Wi-Fi or internet connectivity, lack of electricity in numerous schools, overcrowded classrooms that complicate effective management and assessment, and understaffing issues.

Ng'eno et al. (2021) examined the availability of physical infrastructure for the implementation of the CBC in public primary schools in Kericho County, Kenya, utilizing a descriptive survey design. The participants were 6 Curriculum Support Officers (CSOs), 52 head teachers, and 61 grade 1 teachers. Data were gathered via interview schedules, questionnaires, and observational protocols. Findings suggested that infrastructure positively influenced CBC implementation, with a correlation of 0.336 with a calculated value of 0.029 for head teachers, and a correlation of 0.285 with a calculated value of 0.03 for grade 1 teachers. The deficiency of physical infrastructure, such as dietary and music rooms, yielded mean scores of 2.18 and 1.88, respectively. The response rate for Grade 1 teachers was 1.39 for nutrition and 1.35 for the music lab, respectively. The findings on head teachers' impact on teacher preparation shown a moderate positive correlation of 0.494, with a calculated value of 0.00 in relation to CBC. The grade 1 instructors exhibited a correlation of 0.369, with a computed value of 0.005, indicating significance to the study.

Nthiga et al. (2022) conducted a survey design study on the impact of effective decision-making on the administration of education during the implementation of the CBC in Kiambu County, Kenya. The study was conducted on 43 public primary schools in Kiambu County. The research demonstrated that proficient decision-making fosters a more cohesive and targeted strategy for addressing infrastructural deficiencies, curricular material inadequacies, financial management shortfalls, and human resource gaps, thereby facilitating the effective implementation of CBC programs, accompanied by a robust operational results measurement framework to assess achievements in the curriculum delivery process.

Lorris and Mejicano (2021) examine the pivotal influence of infrastructure and organizational culture on the execution of competency-based curricula (CBC) and individualized pathways in undergraduate medical education. They utilized secondary data to explore competency-based medical education (CBME), an outcome-oriented developmental framework designed to ensure trainees' preparedness for progression through training stages and their ongoing development in unsupervised practice within the program's implementation. The implementation of CBME is a complex and demanding undertaking that necessitates a fundamental transformation in organizational culture and investment in suitable infrastructure. This pertains to the American Medical Association's facilitation and execution of Competency-Based Medical Education (CBME).

4.7 Projection of textbooks requirements for the implementation of the CBC in Senior Secondary Schools in Kenya.

Each learner will need a textbook in the compulsory learning areas which is $152324 \times 5 = 761620$ textbooks for the five compulsory subjects for all learners.

There are currently 413214 textbooks in the five compulsory learning areas occasioning a deficit of $761620 - 413214 = 348406$ textbooks in the five compulsory subjects.

Cheruiyot (2024) contends that inadequate resources and infrastructure constitute a significant barrier to the successful implementation of CBC in Kenyan junior schools. The effective execution of the new curriculum depends on the availability of sufficient instructional resources, technological instruments, and supportive learning settings. Numerous schools across encounter substantial deficiencies in textbooks, digital gadgets, and adequately prepared classrooms. This resource deficiency hinders the effective implementation of CBC activities and restricts students' engagement and access to excellent education.

Okal (2022) discusses the instruction and evaluation of Kenya's indigenous languages within the Competency-Based Curriculum: Challenges and prospective solutions. The study employed a meta-analytical technique to investigate selected educational commissions in Kenya, examining their recommendations for the teaching and learning of indigenous languages and the existence of a clear policy framework for operationalization. The implementation of CBC mandates the instruction of indigenous languages from primary through secondary education. Nonetheless, hurdles to its implementation include insufficient curricular materials, inadequately trained Teachers, limited infrastructure, and ineffective delivery methods. He further observes that the

findings have implications for stakeholders, including policymakers and teacher trainers, regarding the provision of adequate training to prepare Teachers for teaching, as well as for the Ministry of Education to allocate sufficient funding for school infrastructure to facilitate the effective implementation of the programs.

Issa et al. (2024) examine the implementation challenges of a competency-based curriculum in Mtama District Secondary Schools, Tanzania, as reported by student and teacher participants in the study. The CBC is commendable for prioritizing skill building among learners. The study identified a deficiency in curricular materials in schools that hinders the effectiveness of curriculum implementation. The political climate in the country also restricts the adoption of CBC in schools.

Mpate (2023) on the adoption of the Competency-Based Curriculum by biology instructors in Tanzania: Challenges and Opportunities is aware that the execution of the specified programs has persisted for nearly two decades, although Teachers continue to struggle with the implementation process. The study employed a survey design with 32 participants, comprising school heads, heads of Biology departments, Biology teachers, and students. Data were gathered via interviews and observations, employing thematic analysis for qualitative insights. The survey revealed that Biology teachers faced numerous operational hurdles, including deficiencies in pedagogical practices, insufficient staffing, overcrowded classrooms, lack of curricular materials, poor infrastructure, and other initial difficulties.

Keter's (2023) survey in Bomet County revealed that 58.9% of the schools in the area lacked sufficient textbooks for their students. The sufficiency and relevance of textbooks, encompassing current information and adequate quantities, are positively

correlated with the successful execution of a competency-based curriculum (Keter, 2023). Institutions possessing sufficient and suitable texts are more inclined to execute the competency-based curriculum effectively (Wambua, 2021). Schools must guarantee adequate and suitable textbook resources to facilitate the execution of the competency-based curriculum.

Hanushek, Kain, and Rivkin (2008) contend that for educational institutions to promote quality learning, adequate teaching and learning resources are important. A lack of teaching resources has been shown to adversely affect the quality of education. Consequently, the government ought to prioritize effective pedagogical strategies over merely augmenting the availability of educational resources. The inadequacy of the textbooks is due to a lack of cash for their acquisition. Therefore, it is crucial to undertake prior preparation to acquire the requisite texts in anticipation of the CBC's adoption at the Senior School level.

4.8 Projection model on subsidised secondary education capitation requirement for the implementation of the CBC in Senior Secondary Schools in 2026 in Kenya.

Objective 5 was to model projections on subsidised secondary education capitation requirements for the implementation of the CBC in Senior Secondary Schools in 2026 in Vihiga County. Using the current capitation of 22,444 Kenyan Shillings and a projected enrolment of 152324 learners, to effectively budget for CBC 3,419,000,000 Kenyan Shillings need to be set aside.

22444*152324 /*3,419,000,000 KES*

Ajuoga and Keta (2021) conducted a descriptive survey design on the implementation issues of CBC among stakeholders in Kenyan primary schools. The study identified a significant scarcity of teachers and insufficient training orientation for working Teachers about the implementation of the CBC. Deficiencies in curricular materials, infrastructure, and inadequate government financing are among the numerous problems hindering the implementation of the CBC in Kenyan primary schools. Therefore, meticulous preparation must be conducted as the CBC approaches implementation at the Senior School level.

Mulangi (2024) on Financial administration issues on the implementation of CBC in Public Primary Schools in Taita Taveta County, Kenya utilized descriptive survey design in which a target population of 1764 comprising of head teachers, deputy head teachers and Board of Management Chairpersons. Primary data were gathered using questionnaires, and Nassiuma's Formula was employed to obtain a sample of 95 responses from a total of 1964. The findings indicated a strong correlation between delayed CBC Fund disbursement and the deployment of CBC in public schools in Taita Taveta County ($r=0.741$, $p=0.027$). The results indicated a robust positive correlation between financial accountability and the execution of CBC in Public Primary Schools in Taita Taveta County, Kenya ($r=0.619$, $p=0.023$). Suggestions for appropriate and pertinent training for Teachers to prepare them for the implementation of the CBC. Prompt allocation of CBC funds and judicious administration and utilization of CBC monies to enhance the efficacy of CBC implementation in public schools in Taita Taveta County, Kenya.

Nthiga et al. (2022) conducted a study utilizing a survey methodology to examine the impact of effective decision-making on the administration of education within the context of the CBC in Kiambu County, Kenya. The research was conducted in 43 public primary schools located in Kiambu County. The study determined that effective decision-making fosters a more cohesive and targeted strategy for addressing infrastructural deficiencies, curricular material shortages, financial management issues, and human resource gaps, thereby facilitating the prudent implementation of CBC programs, accompanied by a robust operational results measurement framework to assess achievements in the curriculum delivery process.

Nazimana (2021) examined the obstacles encountered by teachers in implementing the CBC in Ugandan secondary schools. The study utilized a descriptive survey approach, involving 50 teachers, 4 head teachers, and 4 education officers in Gulu City, Uganda. The study's findings indicated that teachers encountered several challenges in implementing the CBC in secondary schools in Uganda, including significant infrastructural deficiencies such as inadequate classrooms, science laboratories, computer labs, theater rooms, and CT infrastructure, among others. Teachers were lacking both in quantity and in pedagogical expertise, abilities, and attitudes necessary for the effective implementation of the initiatives in question. There exists insufficient parental engagement, a deficiency in curriculum materials, a shortfall in government funding for the programs, and minimal financial support for the proper operationalization of the programs. These findings have implications for significant stakeholder involvement in the programs, including finance, teacher training through professional development, and ongoing support essential for the effective implementation of the CBC curricula.

Katam (2020) examines the dynamics of implementing the CBC in lower primary schools and its implications for learning in Kenya. The literature review acknowledges that CBC, in contrast to the gradually phased-out 8:4:4 system, is lauded for its skill-based approach, which emphasizes experiential learning and fosters holistic development, allowing individuals to excel in areas of interest and pursue specific career pathways. Despite the initial hurdles posed by deficiencies in infrastructure, personnel, funds, and curricular materials, the CBC would significantly advance the long-sought educational objectives for 21st-century global citizenship.

Mackatiani and Fierer (2023) address the implementation of the CBC in Junior Secondary Schools in Kenya, highlighting the problems that hinder its execution, such as insufficient government funding and the delayed allocation of limited resources to these institutions. There is minimal financing for physical development despite significant infrastructural deficiencies, overcrowding in Junior Secondary School classrooms, and a shortage of science and ICT laboratories. Curricular material deficiencies are prevalent in government-sponsored Junior Secondary Schools inside public institutions. There are manpower deficiencies and a lack of the essential knowledge, abilities, and attitudes required for the effective implementation of JSS courses.

Kuria (2022) discusses the correlation between schools' readiness and the successful execution of the CBC. A study examining teachers' expertise in Nairobi County, Kenya employed human capital theory and utilized a survey research approach, targeting teachers, head teachers, and education managers. The findings indicated that financial challenges pertained to the adequacy, frequency of disbursement, and management of

limited funds at the school level. Deficiencies in infrastructure, shortages in personnel both quantitatively and in pedagogical expertise, competencies, and attitudes on the efficacy of teaching responsibilities..

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter contains a summary of the research findings, conclusions of the study, and recommendations.

5.2 Summary of Research Findings

The study had five objectives, these were: to project the enrolment progression trends of grade 1 2017 CBC cohort into Senior Secondary Schools in 2026 in Kenya, to model projections of teacher requirements for the implementation of the CBC in Senior Secondary Schools in Kenya, to model projections of selected infrastructure requirements for the implementation of the CBC in Senior Secondary Schools in Kenya, to model projections of textbook requirements for the implementation of the CBC in Senior Secondary Schools in Kenya, to model projections on Subsidised Secondary Education capitation requirements for the implementation of the CBC in Senior Secondary Schools in 2026 in Kenya.

5.2.1 Projection model for the enrolment progression trends of grade 1 2017 CBC cohort into Senior Secondary Schools in 2026 in Kenya

The enrolment of CBC grade one cohort of 2017 in Vihiga County is projected to increase by 35.41% from 17990 in 2017 to 24361 in 2026. Junior secondary school enrolment in Vihiga County is projected to increase from 21844 in 2023 to 23491 by 2025 while

Senior secondary school enrolment is projected to increase from 24361 in 2026 to 26198 in 2028.

5.2.2 Projection of teacher requirements for the implementation of the CBC in Senior Secondary Schools in Kenya.

A projection of 3385 teachers was arrived at using 152324 learners and a Pupil Teacher Ratio of 45:1. Currently, there are 2513 teachers for secondary schools in the county occasioning a deficit of 872 teachers, and this figure can only be reliable if the county will maintain the current teachers employed by the Teachers Service Commission. Maintaining this current figure for teachers can be nearly impossible considering out transfers, deaths, dismissals, retirements among other reasons.

5.2.3 Projections of selected infrastructure requirements for the implementation of the CBC in Senior Secondary Schools in Kenya.

Using the projected enrolment, required classrooms were projected using the pupil classroom ratio of 45:1 bringing the number at 3385. Currently there are 1747 classes in the 161 schools sampled occasioning a deficit of 1638 classrooms.

Each science subject will need a laboratory at Junior and at Senior Schools making it 6 laboratories in each school thus the projection is 966 laboratories. With 114 laboratories currently in the 161 schools sampled, a projection of 852 laboratories needs to be constructed.

It is projected that the current boarding facilities will need an improvement of up to 43.98% to cater for the entire CBC enrolment in boarding schools at Senior School level. This suggest that by 2028, the current dining facilities need an improvement of up to 81.37% in order to cater for the entire CBC enrolment at secondary school level.

A projection of the current facilities for technical subjects suggests that by 2028 they need to be more than doubled to cater for the entire CBC enrolment at secondary school level.

5.2.4 Projections of textbook requirements for the implementation of the CBC in Senior Secondary Schools in Kenya

Each learner will need a textbook in the compulsory learning areas which is $152324 \times 5 = 761620$ textbooks for the five compulsory subjects for all learners. This being a new curriculum, new books for the suggested content need to be used. Thus, the old 8-4-4 system textbooks will be rendered irrelevant.

5.2.5 Projections on Subsidised Secondary Education capitation requirements for the implementation of the CBC in Senior Secondary Schools in 2026 in Kenya.

A subsidised secondary education capitation requirement for the implementation of the CBC in Senior Secondary Schools in 2026 in Vihiga County is projected at 3,419,000,000 KES.

This is based on the projected enrolment of 24, 361 learners.

5.3 Conclusion

The research findings led to the following conclusions and generalizations based on the established objectives and the summary of findings on the projection models of the selected requirements for implementing CBC in Senior Secondary Schools in Vihiga County in 2026.

Vihiga County CBC Grade 1 cohort enrolment will increase from 17990 learners in 2017, to 24,361 learners in 2026 when they join Senior School.

Junior School enrolment is projected to go up from 21,844 learners in 2023 to 23491 learners in 2025.

The suggested PTR for Vihiga area Junior and Senior Secondary Schools is 45:1, which means that by 2028, 3,385, teachers will be needed to manage the many pathways of the 2-6-6-3 system of education and improve the quality of education provided in the area. By 2030, there would be a deficit of 872 teachers in Junior and Senior Secondary Schools in Vihiga County if the current number of teachers is maintained.

Senior Schools in Vihiga County will require 5,098 classrooms to attain the pupil classroom ratio of 45:1.

A projection of 6093 toilets is required against the available 3545 considering the MOE guideline of 25 girls per toilet in order to have sufficient toilets for the implementation of CBC at Senior Schools in Vihiga County in 2026.

It is necessary to project 966 laboratories in order to effectively implement CBC at Junior and Senior Schools in Vihiga County. A current shortage of 852 laboratories has resulted

from the fact that only 114 laboratories out of 161 schools were sampled. There were insufficient scientific, computer, and geography labs, and no language labs, as mandated by the current curriculum, in the majority of the schools. According to the study's findings, laboratories are crucial for implementing competence-based curricula effectively. In this case, the competence-based curriculum will not be able to produce the desired results in secondary schools unless the necessary laboratory facilities are built. Due to overcrowding in practical sessions and perhaps poor performance on examinations, students study more theoretically than practically due to a lack of adequate laboratory facilities.

It is projected that the current boarding facilities in Vihiga County will need an improvement of up to 43.98% in order to cater for the entire CBC enrolment in boarding schools at Senior Schools.

A projection of the current facilities for technical subjects shows that they need to be more than doubled in order to cater for the entire CBC enrolment at Senior secondary school level by 2028.

To subsidise secondary education in Senior Secondary Schools in 2026 in Vihiga County, a projection of 3,419,000,000 Kenya Shillings is required.

5.4 Recommendations

5.4.1 Recommendation for Policy

From the research findings, the following recommendations were made:

The analysis clearly indicated that secondary schools in Vihiga County will require additional instructors, classrooms, boarding facilities, technological facilities, and restrooms in order to accommodate the projected increase in student enrollment by 2026. In order to accommodate the expected rise in enrollment at the Senior School in 2026, it is recommended that additional Constituency Development Funds be granted to the existing day secondary schools in Vihiga County to enhance their instructional facilities.

This report also suggests that Boards of Management should seek funding to construct more physical infrastructure and expand the existing 161 secondary schools. This will enable schools to provide the high-quality education outlined in Kenya Vision 2030. There will be a rivalry among Junior Secondary students, Senior Secondary students, and 8-4-4 students due to the limited availability of laboratory facilities and equipment. Moreover, the absence of Geography and Language laboratories impeded the efficient progress and attainment of necessary skills in those disciplines. This study suggests that the MOE, Science and Technology should develop a policy to ensure that schools have adequate laboratory facilities and teaching-learning resources for effective curriculum implementation. The policy should focus on establishing, procuring, and utilizing these resources efficiently. The government should engage in collaboration with stakeholders, including the community, to provide the necessary facilities such as science, geography, language, and computer laboratories.

The Teachers Service Commission should implement a systematic strategy to hire an additional 872 Teachers for teaching in Junior and Senior Secondary Schools in Vihiga County by 2028.

The analysis clearly demonstrates that Vihiga County has numerous sub-county secondary schools that are fiscally unfeasible and incapable of accommodating Senior school classes. This report suggests that the MOE should evaluate these schools in order to elevate them to the status of Junior Secondary Schools.

The MOE should conduct an assessment of sub-county and secondary schools to identify those with sufficient facilities that can be upgraded to senior secondary schools.

This report suggests the establishment of day school wings in every senior secondary school as a means to increase student enrollment without overburdening boarding facilities.

5.4.2 Recommendations for further research

- i. The adoption of the 2-6-6-3 education system is having an effect on all schools in Kenya. Hence, this research proposes carrying out a comparable investigation in different counties around the nation to ascertain the educational requirements necessary for delivering top-notch education under the 2-6-6-3 system in 2026 at the Senior Secondary School level.
- ii. The study found that there is a steady rise in the enrollment of students in Primary, Junior Secondary, and Senior Secondary Schools in Vihiga County. Hence, it is imperative to do a research study in Vihiga County to ascertain the means by which current secondary schools can be enlarged to handle the projected increase in student enrolment by the year 2026.
- iii. The capacity of teachers at all levels needs to be improved and also begin sensitizing instructors in tertiary institutions and lecturers in universities on CBC.

REFERENCES

- Abdullahi O. (2020). *School Based Factors Influencing Implementation Of Competency Based Curriculum In Public Pre-Schools In Garissa Sub-County, Garissa County Kenya* (Unpublished Masters Project, University of Nairobi, Kenya)
- Aburime, E.F. (2004). *Refocusing Research Technology and Mathematics Education: A Case for Mathematics Laboratory*. Akure: Proceeding of the 45th Annual Conference of Science Teachers' Association of Nigeria.
- Abuya, B. A. (2017). Why the New Education Curriculum is a Triumph for Kenya's Children. *The Conversation*.
- Achimungu, L. (2016). Factors Affecting the Effective Implementation of Senior Secondary Education Chemistry Curriculum in Kogi State, Nigeria. *International Journal of Scientific and Research Publications*. 6 (5), 562-566.
- Agboola, B. M., & Adeyemi, J. K. (2013). Projecting Enrollment for Effective Academic Staff Planning in Nigerian Universities. *Educational Planning*, 21(1), 5-17.
- Ahmed, S. K. (2000). *Projection of Population, Enrolment and Costs to the State of Primary, Secondary and Higher Education in Bangladesh for the Period 2000-2020*. Bangladesh, CPD-UNFPA paper 8.
- Ajuoga, M.A., & Keta, E. (2021). Competency Based Curriculum for Kenyan Primary schools: Implementation Challenges among stakeholders in Kenya. *International Journal of Innovation Research and advanced studies (IJIRAS)* 8(3), 45-56
- Akala, B. M. M. (2021). Revisiting education reform in Kenya: A case of Competency Based Curriculum (CBC). *Social Sciences & Humanities Open*, 3(1), 100107. <https://doi.org/10.1016/j.ssaho.2021.100107>
- Akala, B.M. (2021). Revisiting Educational Reform in Kenya: A Case of CBC. *Journal of Social Sciences, Humanities and Open* 3(1), 100107

- Akhwesa, S.G. (2023). Preparedness of facilitators on implementation of CBC in Pre-primary schools of Kayole Ward, Nairobi County, Kenya. *Competency* 13(1),123-130
- Akpan, O. (2006). *Laboratory Facilities for Chemistry Teaching*. Unpublished Seminar Paper. Nigeria: University of Calabar.
- Alake-Tuenter, E., Biemans, H. J. A., Tobi, H., Wals, A. E. J., Oosterheet, I., & Mulder, M. (2012). Inquiry-based science education competencies of primary school teachers: A literature study and critical review of the American National Science Education Standards. *International Journal of Science Education*, 34(17), 2609–2640. *CrossRefGoogle Scholar*.
- Alufohai, P.J. and Aziegbe, M. (2016). The influence of Language Laboratory in the academic Achievement of Students in French Language in Edo state secondary school. *European Journal of Language Studies*, 3 (2), 75-80.
- Ambaa, C. (2015). Analysis of the Kenyan 8-4-4 system of education in relation to aims of education for self-reliance. Master of Education (Philosophy of Education) of the University of Nairobi, August 2015.
- Amukowa, D. (2020). Competency Based Curriculum in Kenya: Opportunities and Challenges. *Competency* 11(32)
- Amutabi, M. N. (2019). Competency Based Curriculum (CBC) and the end of an Era in Kenya's Education Sector and Implications for Development: Some Empirical Reflections. *Journal of Popular Education in Africa*. 3(10), 45 – 66.
- Amutabi, M., & Nsenga, M. (2019). Competency-Based Curriculum (CBC) And The End Of An Era In Kenya's Education Sector And Implications For Development: Some Empirical Reflections.
- Amutabi, M. N. (2019). Competency-Based Curriculum (CBC) And The End Of An Era In Kenya's Education Sector And Implications For Development: Some Empirical Reflections. *Journal Of Popular Education In Africa*. 3(10), 45 – 66.

- Amutabi, M. N. (2003a). The 8-4-4 system of education in Kenya: A Retrospection. *International Journal of Educational Development*. 23(2003) pp.127-144
- Amutabi, N. M. (2003b). "Political Interference in the Running of Education in Post independence Kenya; A Critical Retrospection." *International Journal of Educational Development* 23.
- Anderson, L. W. and D. R. Krathwohl. 2001. *A taxonomy for learning, teaching and assessing: A revision of Bloom's taxonomy*. New York: Longman.
- Ashiono, B. (2018). Determinants of Information and Communication Technology Integration in Learning of Numeracy Concepts in Lower Primary Schools in Mombasa County, Kenya. Unpublished thesis, Kenyatta University.
- Ausubel, D. (1963). *The Psychology of Meaningful Verbal Learning*. New York: Grune and Stratton.
- Baluch, M. & Shahid, S. (2008). Determinants of Enrolment in Primary Education. A Case Study of District Lahore. *Pakistan Economic and Social Review* Volume 46, No. 2 (Winter 2008), pp. 161-200.
- Blumenthal, D., & Rasmussen, J. (2015). State approaches to competency-based education to support college and career readiness for all students. College & Career Readiness & Success Center at American Institutes for Research. Retrieved June 30, 2020, from <https://ccrcenter.org/products-resources/ask-the-ccrs-center/state-approaches-competency-based-education-support-college>.
- Bostic, J. D., Pape, S. J., & Jacobbe, T. (2016). Encouraging sixth-grade students' problem-solving performance by teaching through problem solving. *Investigations in Mathematics Learning*, 8(3), 30–58. <https://doi.org/10.1080/24727466.2016.11790353>
- Bowen, G. A. (2009). Document analysis as a qualitative research method. *Qualitative Research Journal*, 9(2), 27-40. doi:10.3316/QRJ0902027
- Campbell, Jr. H. S. (1997). School Enrolment in an Extended Demographic Model. *Journal of Economic and Social Measurement*, 23, 27-42. <https://doi.org/10.3233/JEM-1997-23102>

- Carracio C., Wolfsthal S., Englander, R., Ferentz, K., Martin, C. (2002). *Shifting Paradigms: from Flexner to competencies*. *Academic Medicine*. 77(5): 361-367.
- Chabari, E.B. (2010). Challenges Facing Effective Implementation of Free Secondary Education in Public Secondary Schools in Kangundo District, Kenya. Unpublished Master's Thesis. Chuka University College.
- Chacha, J., Onyango, D., & Augustine. (2022). Challenges faced by teachers in implementation of CBC Chemistry Curriculum in Public Secondary Schools in Nyamagana District, Tanzania. *Journal of Research and Innovations and Implications in Education* 6(1), 346-358
- Chang, G. C. and Radi M. (2001). Educational planning through computer simulation. *Education Policies and Strategies* 3. U.N.E.S.C.O
- Chepkonga, M. C. (2023). Training Needs by Head Teachers in the Implementation of Competency-Based Curriculum in Kenya's Primary Schools: *A Study of Marakwet East Sub County East African Journal of Education Studies*, 6(3), 526-535. <https://doi.org/10.37284/eajes.6.3.1666>.
- Chepkonga, M.C. (2017). Training needs for head teachers in management of ECDE curriculum implementation in primary schools in Marakwet District, Kenya. *American Based Research Journal*, 6(8), 6 – 14.
- Cheptoo R. (2019). The 'Africanized' Competency Based Curriculum: The Twenty-First Century Strides. *Shanlax International Journal of Education*, vol. 7, no. 4, 2019, pp. 46-51.
- Cheruiyot, B. (2024). Challenges Faced in the Implementation of Competency-Based Curriculum (CBC) in Junior Schools in Kenya. *East African Journal of Education Studies*, 7(3), 260-266. <https://doi.org/10.37284/eajes.7.3.2098>.
- Cho, S.-Y. (2017). Realization plan of connection between the competence-based curriculum, teaching-learning method, and evaluation in high schools. *Journal of Secondary Education Research*, 65(1), 255–281. <https://doi.org/10.25152/ser.2017.65.1.255>

- Choi, J., & Woo, A. (2020). Effect of science practice-based class on improving middle school students' science core competency. *Journal of Research in Curriculum & Instruction*, 24(1), 11–22.
- Choi, S.-J. (2018). Practices of competency-based curriculum: Cases at the high school level. *The Journal of Curriculum Studies*, 36(3), 169–196. <https://doi.org/10.15708/KSCS.36.1.8>
- Claro, M. and Ananiadou, K. (2009). *21st Century Skills and Competences for Millenium Learners in OECD Countries*. OECD.
- Cresewell, J. (2011). *Educational Research: Planning, Conducting, and evaluating quantitative and qualitative research*. New York: Pearson
- Creswell, J. W. (2007). *Qualitative inquiry and research design: Choosing among five approaches (2nd ed.)* Thousand Oaks, California: Sage Publication, Inc.
- Combs, D.H. (1968). *World Educational Crisis: A Systems approach*, New York: Oxford University Press.
- Creswell, J. W. (2008). *Educational Research: Planning, Conducting, and Evaluating Quantitative and Qualitative Research*. Upper Saddle River, New Jersey: Pearson Education Inc.
- Daba, T. M. and Anbesaw, M. S. (2016) Factors Affecting Implementation of Practical Activities in Science education in Some Selected Secondary and Preparatory Schools of Afar Region, North East Ethiopia. *International Journal of Environmental & Ecience Education*, 11 (12), 5438-5452
- Darling-Hammond, L., Meyerson, D., LaPointe, M., & Orr, M.T. (2009). *Preparing principals for a changing world: Lessons from effective school leadership programs*. San Francisco, CA; Jossey-Bass.
- Deißinger, T. and S. Hellwig. 2011. *Structures and functions of Competency-based Education and Training (CBET): A comparative perspective*. Mannheim, Germany: GIZ.

- De Ferranti, D., Guillermo E. P., Indermit Gill, J., Luis G., William F.M., Carolina, S., & Norbert, S. (2003). *Closing the Gap in Education and Technology*. Washington, D.C.: The World Bank.
- Delloittete and Touch Management Consultants Limited. (1995). *Graduate Labour Market Study for the commission for Higher Education. 2nd Draft Report*. Nairobi: Delloittete and Touch Management Consultants Ltd.
- Deye, S. (2018, August). A look at competency-based education in K-12 schools. National Conference of State Legislatures, 26(30).
- Di Gropello, E. (2006). *Meeting the Challenges of Secondary Education in Latin America and East Asia: Improving Efficiency and Resource Mobilization*. Washington D.C.: The International Bank for Reconstruction and Development.
- Dilmore, T., Moore, D. and Bjork, Z. (2011) *Implementing Competency-Based Education*. A Process Workbook 2009-2001.
- Eamon, S. (2005). An Evaluation of Curriculum Implementation in Primary Schools. English, Mathematics and Visual Arts. (Department of Education and Science, Ed.). Dublin: Stationery Office.
- Eshiet, I.T. (1996). *Improvisation in Science Teaching Philosophy and Practice*. Abak: Belpot Press.
- Elimu Llibrary(2019) Competency Based Curriculum in Kenya: Importance and Challenges of Implementation Kirby. B., R. Competence-based education in the United States <https://www.theelephant.info/features> (2019) /will-the-new-competency-based-curriculum-lead-to-declining educational-standards-in-kenya/
- Evans, C. M., Graham, S. E., & Lefebvre, M. L. (2019). Exploring K-12 competency-based education implementation the Northeast states. <https://doi.org/10.1177/0192636519877456>
- Faludi, A. & Needham, B. (1973). Planning and the public interest. *Journal of the Royal Rown Planning Institute, 12, 57*.

- Gapfizi, P., Mbanite, E.S.&Ian, I.M. (2017). Challenges Faced by Physics Teachers During the implementation of CBC in Rwanda. *Curriculum Perspectives* 35(3),12-20
- Ghavifekr, S. & Rosdy, W.A.W. (2015). Teaching and learning with technology: Effectiveness of ICT integration in schools. *International Journal of Research in Education and Science (IJRES)*, 1(2), 175-191.
- Gogo, J.O. (2003). *Impact of Cost Sharing Strategy on Access, Equity and Quality of Secondary Education: A Case Study of Rachuonyo District*. Unpublished M.Ed thesis, Maseno University.
- Government of Kenya. (2005). *Economic Survey 2005*. Nairobi: Government Printers.
- Gould, E. (1993). An Interactive Flow Model for Projecting School Enrolments. *International Review of Education*, 39(4), 319-332.
- Guloba, M., Wokaloda, J., & Bategeka, L. (2010). Does teaching methods and availability of teaching resources influence pupils performance? Evidence from four districts in Uganda. *Ugandan Economic Policy Research Centre: Research Series No. 77*
- Grissom, J. A., Loeb, S., & Master, B. (2013). Effective instructional time use for school leaders: Longitudinal evidence from observations of principals. *Educational Researcher*, 42(8), 433–444.
- Hager, W.R. (1974). An investigation of verbal behaviour and learning climate in undergraduate engineering classroom. *Journal of Research in Science Teaching*, 11(2), 121-131
- Hall G. E. (2007). *Competency Based Education: A Process for the Improvement of Education*. Pentice. Hall.
- Hall, G. E. & Hord, S. M. (2001). *Implementing Change: Patterns, Principles and Potholes*. Boston et al.
- Hall, G.E. & Hord, S.M., (1987). *Change in schools: Facilitating the process*. Albany, NY: State University of New York Press.

- Hamre, B. K., & Pianta, R. C. (2010). Classroom environments and developmental processes: Conceptualization and measurement. *In Handbook of research on schools, schooling and human development* (pp. 43–59). Routledge.
- Hanushek, E. A., Kain, J. F., O’Brien, D. M., & Rivkin, S. G. (1998). The economics of schooling: Production and efficiency in public schools. *Journal of Economic Literature*, 24(1), 1141–1177
- Hernández, L. E., & Darling-Hammond, L. (2019). Deeper learning networks: taking student-centered learning and equity to scale. Research Brief, October 2019. Learning Policy Institute. Retrieved from <https://files.eric.ed.gov/fulltext/ED603414.pdf>
- Hitchcock, T. (2013) Changing the Rules: Competency Based Learning in Higher Education. Retrieved June 14, 2024, from researchnetwork.pearson.com.
- Hipolite J. (2019). *Teachers’ Strategies In Addressing Challenges Of Implementing CompetenceBased Curriculum: The Case Of Selected Public Secondary Schools In Morogoro Municipality* (Unpublished Master’s Thesis In Mzumbe University in Tanzania)
- Hodge, S. (2007). The origins of competency-based training. *Australian Journal of Adult Learning*, 47(2), 179–209. [Google Scholar](#)
- Hofstein, A., & Ginetta, A. (1998). *Trends in Assessment of Laboratory Performance in Secondary Schools in Instruction*. Iowa: University of Iowa Press.
- Hong, W.-P., & Lee, K. H. (2012). Implementation of competency-based curriculum in practice: Based on the case of Quebec, Canada. *Korean Journal of Curriculum Studies*, 34(2), 1–18.
- Hussein, A. (2023). The challenges of implementation of CBC in Northern Kenya. *Africa Journal of Education and Practice* 9(3),59-67
- IBE-UNESCO (2017). *External Report on Curriculum Pilot Implementation*, Nairobi, Kenya.
- IBE-UNESCO (2015). *What makes a good quality curriculum? In progress Reflection*. SNC-2 Geneva Switzerland.
- IBE-UNESCO (2015). *Repositioning and Re-conceptualizing the Curriculum for Effective Realization of SDG 4 for Holistic Development and Sustainable Ways of Living*. Geneva, Switzerland.

- IBE-UNESCO (2013). *Training Tools for Curriculum Development: A Research Pack*. Geneva, Switzerland.
- Immegart, G. I. & Pileck, F. J. (1973). *An introduction to system for the educational administrator*. London: Addison-Wesley Publishing Company.
- Isaboke, H., Mweru, M., & Wambiri, G. (2021). Teacher Preparedness and Implementation of the Competency Based Curriculum in Public Pre-Primary Schools in Nairobi City County, Kenya. *International Journal of Current Aspects*, 5(3), 32-53. <https://doi.org/10.35942/ijcab.v5i3.186>
- Issa, Z., Mwakapina, J., & Nvinandi, O. (2024). Competency Based Curriculum in practice: Implementation prospects and challenges in Mtama District Secondary Schools, Tanzania. *International Journal of Research* 13(5), 29-39
- Javinaitive, P., & Reddy, P.J.V. (2022). Perceptions Towards implementation of CBC in Secondary Schools in Uganda. *Africa Journal of Education and Practice* 8(2), 87- 99
- Jeng'ere (2017). *The Why, What and How of Competency Based Curriculum Reforms- The Kenyan Experience*. Nairobi. Kenya.
- Kafyulilo, A. C., Rugambuka, I. B., & Moses, I. (2013). Implementation of Competency Based Teaching in Morogoro Teachers ' Training College , Tanzania, 4(2), 311–326.
- Katam, E.J. (2020). Dynamics in the implementation of CBC in lower primary schools: Implications on learning in Kenya. *Journal of Popular Education in Africa* 4(11), 52-62
- Kabita, D. N., & Ji, L. (2017). *The why, what and how of the competency-based curriculum reforms: The Kenyan experience*. UNESCO and International Bureau of Education: Geneva. Retrieved April 25, 2022, from <https://www.slideshare.net/jmjmwanzo/the-why-what-and-how-of-competency-based-curriculum-2018-bydavid-nyengere-kabita>
- Kamario, T.T., & Otieno, O.K. (2022). Effects of CBC on students' educational achievement: A study of secondary schools in Arusha City, Council, Tanzania. *Journal of Research Innovation and Implication in Education* 6(1), 201-210

- Kanyonga, L., Mtana, N., & Wendt, H. (2019). Implementation of competence-based curriculum in technical colleges: The case of Arusha City, Tanzania. *International Journal of Vocational and Technical Education*, 11(1), 1-20.
- Kelly (2018). *List of Core Competencies for Teachers* . Sub Urban News Publication, Ohio, USA.
- Keter, P. (2023). Influence of Primary Schools' Infrastructure on the Implementation of Competency Based Curriculum: A Case of Bomet Central Sub-County, Kenya. *Journal of Research Innovation and Implications in Education*, 7(2), 199 – 209. <https://doi.org/10.59765/ksun8141>.
- Kenya Institute of Curriculum Development (KICD). (2017). Basic Education Curriculum Framework. Retrieved July 30, 2020, from <https://kicd.ac.ke/wp-content/uploads/2017/10/CURRICULUMFRAMEWORK.pdf>
- KICD (2017). *Facilitators Trainers Manual for Early years Education (EYE) Curriculum*. Nairobi. Kenya.
- KICD (2017). *Basic Education Curriculum Framework*. Nairobi. Kenya.
- KICD (2016). *Basic Education Framework (BECF)*. Nairobi. Kenya.
- KICD (2016). *A Needs Assessment of Curriculum Change*. Nairobi. Kenya.
- Kigwilu, P. C., & Akala, W. J. (2017). Resource utilisation and curriculum implementation in community colleges in Kenya. *International Journal for Research in Vocational Education and Training (IJRVET)*, 4(4), 369-381.
- Kinyunyu. (2020). CBC Implementation: A Case of Selected Secondary schools in Mufundi District, Tanzania. *Journal of Research Innovation and Implication in Education* 4(2),34 41
- Kiprotich, E. (2020). Effectiveness Of Competence-Based Curriculum Implementation On Learners In Public Primary Schools Kericho East-KerichoCounty Page<https://ir.greetsauniversity.ac.ke/bitstream/handle/20.500.12736/2025/EDGAR%20KIPROTICH%20>.
- Kisirkoi, F., & Kamanga, A. N. (2018). Continuous Teacher Professional Support for Effective Implementation of Basic Education Curriculum Framework. *Education Quarterly Reviews*, 1(2), 309 - 317.
- Kitta, S. and Tilya, F. (2010). *The Status of Learner Centred Learning Assessment in*

- Tanzania in the context of the Competence-Based Curriculum*. Papers in Education and Development. (ISSN 0856-4027). Issue: 29. Pages: 77-91.
- Kimalu, P. K., Nafula, N., Manda, D.K, Bedi A.S., Mwabu G., and Kimenyi, M.S. (2001). "Education Indicators in Kenya." KIPPRA Working Paper No.4, Nairobi.
- KNUT, (2019). Influence of Teachers Preparedness on Implementation of Competency Based Curriculum in Primary Schools in Kenya.
- Kinuthia, W. (2009). Educational Development in Kenya and the Role of ICT. *International Journal of Education and Development Using ICT*. Vol. 5, No. 2.
- Kizito N. (2019). *Rwandan New Competence-Based Curriculum Implementation and Issues: Sector-Based Trainers LWATI: A Journal of Contemporary Research*, 16(1), 24-4, 2019 ISSN: 1813-222, 2019.
- KNBS (2019). 2019 *Kenya Population and Housing Census: Distribution of Population by Age and Sex*, Vol 111. Nairobi: KNBS.
- Komba, S., & Mwandanji M. (2015). Reflections on the Implementation of Competence Based Curriculum in Tanzanian Secondary Schools. *Journal of Education and Learning*, 4(2), 45 - 58
- Komba, S. C., & Mwandanji, S. (2013). The Effectiveness of Teaching Practice in Improving Student Teachers Teaching Skills in Tanzania. *Journal of Education and Practice*, 4(1), 157-163.
- Koo, K. (2020). A study on the application method for the competence-based curriculum: Focused on the Gyeongnam elementary school. *Journal of Learner-Centered Curriculum and Instruction*, 20(6), 169–191. <https://doi.org/10.22251/jlcci.2020.20.6.169>
- Koskei B. K, & Chepchumba E. (2020). Teachers' competency as a cornerstone on the implementation of competency based curriculum in Kenya. A case of lower primary schools in Nakuru county. *International Journal of Education and Research*. 8(2):1-0.

- Kothari, C. R. (2014). *Research Methodology: Methods and Technique*. New Delhi: New Age Publishers.
- Kouwenhoven, W. (2009). Competence-based curriculum development in higher education: Some African experiences. In M. Cantrell, R. Kool, & W. Kouwenhoven (Eds.), *Access and expansion: Challenges for higher education improvement in developing countries* (pp. 125–146). Amsterdam: The Netherlands: VU University Press. [Google Scholar](#)
- Kubai, E. (2023). A Critical Review of Challenges Facing Implementation of CBC in Nairobi County, Kenya. *Journal of Education Practices* 3(3),1-13
- Kuria, A.W. (2022). Relationship between school preparedness and effective implementation of CBC: A study of teachers' knowing in Nairobi County, Kenya. *Journal of Education Practices* 2(1),14-26
- Kwak, E. H. (2019). The implications for the issues surrounding the competency-based curriculum. *CNU Journal of Educational Studies*, 40(2), 61–81. <https://doi.org/10.18612/cnujes.2019.40.2.61>
- Lagoke, B.A. (1997). Toward an elimination of the gender gulf in science concept attainment through the use of environment analogs. *International Journal of Science Education*, 9(4), 365-367.
- Levine, E., & Patrick, S. (2019). *What Is Competency-Based Education? An Updated Definition*. Aurora Institute.
- Lewin, K.M. and Sayed Yusef. 2005. *Non-Government Secondary Schooling in Sub-Saharan Africa. Exploring the Evidence in South Africa and Malawi*. DfID Education Papers: 59. London: DfID.
- Lewin, K.M. 2002. —*The Costs of Supply and Demand for Teacher Education: Dilemmas for Development*. *International Journal of Educational Development*. vol. 22(3–4): 221–242.
- Lockheed, M., Verspoor A., and Associates (1991). *Improving Primary Education in Developing Countries*. London: Oxford University Press.

- Masika, S.J. (2020). Competency Based Curriculum implementation: Assessing Kenya's Readiness. *International Journal of Curriculum and Instruction* 14(1), 22-34
- May, H., Huff, J., & Goldring, E. (2012). A longitudinal study of principals' activities and student performance. *School Effectiveness and School Improvement*, 23(4), 417–439. <http://eric.ed.gov/?id=EJ984230>
- Mbeche G. F. (2003). *Projection of Enrolment in B.Ed. Programme to Meet the Demand of Teachers for Integrated English in Public Secondary Schools in Kenya*. Kenyatta University Library.
- Mikanjuola, S.A. and Sidiq, O. B. (2013). Geography laboratory and observation centre: The missing vital infrastructure for effective teaching of geography in school. *Afro Asian Journal of Social Sciences*, 4 (4), 1-11.
- Miller, J. (1990). *The educational spectrum: Orientations to curriculum*. New York: Longman.
- Mehta, A. C. (2004). Projections of Population, Enrolment and Teachers. *Journal of Educational Planning and Administration*, Volume VIII, Number 1, new Delhi.
- Mehta, A. C. (1994). Enrolment Projections: Education for All in India. *Journal of Education Planning and Administration*, VIII (1), Number 1, January, New Delhi.
- Mercy, M. (2016). Effectiveness of using language laboratory in teaching English among standard six students in Coimbatore district. *International Journal of Research Granthaalayah*, 4 (5), 22-26.
- Miller, J. P., & Seller, W. (1990). *Curriculum, Perspectives and Practice*. Mississauga: Copp Clark Pittman. (Ch 9, pp 205-209).
- Mkware, S., Mutai, P., Murigi, P., and Bartoo V. (2004, December 25). Nakuru is Rift Valley Champion in KCPE. *The Standard News Paper*, p.1-2
- MoE (2019). Sessional Paper No.1. *Policy Framework for Reforming Education, Training and Research for Sustainable Development*. The Government Printer. Nairobi.

- MoE (2018). *National Education Sector Strategic Plan (2018-2022)*. The Government Printer. Nairobi.
- Mohammed, A. (2017). The Role of Language Laboratory in English Language Learning Settings. *English Language Teaching*, 10 (2), 86-93.
- Mohamed M., & Karuku S. (2017). *Implementing a Competency-Based Curriculum in Science Education*. In: Otulaja F.S., Ogunniyi M.B. (eds) *The World of Science Education. Cultural and Historical Perspectives on Science Education: Handbooks*. Rotterdam: Sense Publishers.
- Molapo, M. R. (2018). Politicising curriculum implementation: The case of primary schools. *South African journal of education*, 38(1), 41 – 56
- Muneja, M. S. (2015). Secondary School teachers' implementation of the competency-based curriculum in the Arusha Region, Tanzania (Doctoral dissertation, University of South Africa).
- Ministry of Education. (2012). *Task force on the Re-Alignment of the Education Sector to the Constitution of Kenya 2010*. Nairobi; Government printer.
- Ministry of Education. (2009). Education Facts and Figures. EMIS; Ministry of Education, Kenya.
- Ministry of Education. (2007). *Report of the Task Force on Affordable Secondary Education*. Nairobi: ShrendPub.LTD.
- Ministry of Science Education and Technology. (2005a). Sessional Paper No.1 of 2005 on Policy Framework for Education, Training and Research: Meeting the Challenges of Education, Training and Research in Kenya in the 21st Century. Nairobi: MOEST.
- Ministry of Science Education and Technology. (2005b). *Study of Teacher Staffing Norms: Draft Report*. Nairobi: TSC
- Ministry of Education. (2004). *Education in Kenya: Challenges' and Policy Responses. Paper Prepared for the presentation at the Council on Foreign Relations Washington D.C.*

- Miller, J. P., & Seller, W. (1990). *Curriculum, Perspectives and Practice*. Mississauga: Copp Clark Pittman. (Ch 9, pp 205-209).
- Mkapa, B. (2004). Indigenous knowledge—a local pathway to global development. In R. Woytek, P. Shroff-Mehta, & P. C. Mohan (Eds.), *Indigenous knowledge: Local pathways to global development* (pp. 1–3). Washington, DC: World Bank. [Google Scholar](#).
- Moore, A., Destefano, J., Terway, J & Balwaz, D. (2008). *Expanding Education for Sub-Saharan Africa: Where is the Teacher?* Washington, D.C.: The World Bank.
- Matere, A. (2024). From 8:4:4 to CBC: Emerging Issues of Transition in Education in Kenya. *International Journal of Curriculum and Instruction* 16(1),20-31
- Mathibe, I. (2007). The professional development of school principals. *South African Journal of Education*, 27(3)523 – 540.
- Mogere, V.B., &Mbatanu. (2023). Determinants of CBC Implementation in selected Public primary schools in Nairobi City, Kenya.*Journal of Public Policy and Governance* 3(1),39 50
- Mokua, B. (2010). *An Evaluation Of The Curriculum Development Role Of Teachers As Key Agents In Curriculum Change* (Unpublished Master Of Education Thesis, North-West University, Potchefstroom)
- Momanyi, J.M., &Rop, P.K. (2020). Teacher preparedness for the implementation of CBC in Kenya: A survey of early grade primary school learners in Bomet East Sub-County, Kenya. *The Cradle of Knowledge African Journal of Education and Social Science Research* 7(1),10-15
- Mpate. (2023). Biology teachers’ implementation of CBC in Tanzania: Challenges and Opportunities. *Journal of Biological Education* 4(1),1-21
- Mombo, U. (2022). Competency Based Curriculum in the teachers’ training colleges: the challenges. *European Journal of Alternative Education Studies* 7(1),112-121
- Mucheni, B.M. (2021). Teacher Perspectives on Implementation of Competency Based Curriculum in Kenya. *International Journal of Capacity Building in Education Management* 4(3),15-27

- Muchiri, J. W., Kithinji, E. G., & Mwangi, L. (2021). Effect of school facilities on academic performance of pupils in Kenya. *Journal of Education and Practice*, 12(5), 123-129.
- Mugambi, M. (2006). Factors influencing students' performance in the KCSE examination in Meru South District, Kenya (Unpublished M.Ed. research report). University of Nairobi, Nairobi.
- Mugenda O. And Mugenda A. L. (2003). *Research Methods Quantitative and Qualitative*. Nairobi. Kenya.
- Mukami, N.E.(2015). Extent of utilization of laboratories in teaching and learning chemistry in public secondary schools in Meru south district, Kenya. MED Thesis. Nairobi: Kenyata.
- Mulangi, M. (2024). Financial Administration Challenges on the implementation of CBC among Public Primary Schools in Taita Taveta County, Kenya. *International Journal of Capacity Building in Education Management* 6(3),1-6
- Mulkeen, A., Chapman, D., DeJaeghere, J., & Bryner, K. (2005). *Recruiting, Retaining, and Retraining Secondary School Teachers and Principals in Sub-Saharan Africa. GEC 95 Working Paper Series*. Washington D.C.: Academy for Education Development and the World Bank.
- Muneja, M. S. (2015). Secondary School Teachers Implementation of the Competence Based Curriculum in Arusha Region, Tanzania. University of South Africa.
- Mungai, L. N., & Rotich, J. K. (2022). Effect of classroom furniture adequacy on implementation of competency-based curriculum in public primary schools in Kenya. *International Journal of Education and Research*, 10(1), 1-14.
- Munyao, A., Nduku, E., & Ndanu, C. (2023). Teacher Preparedness on the implementation of CBC in Public Primary Schools in Lamu West Sub-County, Kenya. *Journal of Popular Education in Africa* 7(7),20-32
- Munyasia, N.M., & Maureen, A.O. (2021). Kenya's Vision 2030: The Efficacy of CBC in Primary and Secondary Schools in Siaya County, Kenya. *Journal of Popular Education in Africa* 5(1),88-100

- Munyui J. M., Morris R. J., Wawire A. B., & Oh C. (2023). Implementing Competency Based Curriculum (CBC) in Kenya: Challenges and Lessons from South Korea & USA. *Journal of Education and Learning*: Vol 12, No 3 ISSN 1927- 5250 E-ISSN 1927- 5269.
- Muriungi, P., & Gachago, D. (2021). Implementation of Competency-Based Curriculum (CBC) in Kenya: Challenges and Prospects. *Journal of Education and Practice*, 12(4), 128-136.
- Muriuki, N.J. (2022). Factors affecting execution of CBC in Primary Schools in North Eastern Kenya.UNICAF university. *East African Journal of Education* 5(2),76-87
- Muthersbaugh, D., Kern, A. L., & Charvoz, R. (2014). Impact through images: Exploring student understanding of environmental science through integrated place-based lessons in the elementary classroom. *Journal of Research in Childhood Education*, 28(3), 313–326. <https://doi.org/10.1080/02568543.2014.913217>
- Mwang'ombe, A.M. (2021). Competency Based Curriculum in Kenya: Teachers' understanding and Skills, reality on the ground, success, recommendations.[https://doi.org/10.13140/RG2\(35914.49605\)](https://doi.org/10.13140/RG2(35914.49605))
- Mwenda, A., & Kihoro, J. M. (2021). Challenges facing implementation of the competency-based curriculum in Kenyan primary schools: a review of literature. *Journal of Education and Practice*, 12(10), 19-24
- Namubiru, A., Kisembo, M., Kasute, T., &Kagomba, E. (2024). Perceptions of Teachers on the implementation of CBC in secondary schools in Bundibugyo and Ntoroke Districts of Uganda. *East African Journal of Education* 7(3),13-27
- NATIONAL EDUCATION SECTOR PLAN (NESP). (2015). Volume One: Basic Education Programme Rationale and Approach. Retrieved June 31, 2020, from <https://www.education.go.ke/index.php/downloads/file/83-national-education-sector-plan-volume-one-basic-education-programme-rationale-and-approach>.
- Ndayambaje, I. (2018). *Implementing CBC: Successes and Challenges*. Rwanda Education Board.

- Ndolo M. A, Simatwa E.M.W. and Ayodo TMO (2016). Impact of Free Secondary Education Policy on Access to Secondary School Education in Kenya. A Case Study of Mbita and Suba Sub-Counties. *Greener Journal of Educational Research*, 6(2): 067-085, <http://doi.org/10.15580/GJER.2016.2.032816070>
- Ngeno V. C. (2015). Influence of Free Secondary Policy on Gender Parity, Repetition, Dropout, Wastage and Student's Academic Achievement in Kericho County, Kenya. Unpublished PhD Thesis. Maseno University.
- Ngeno, B. C., Sang, H. C., & Chemosit, C. (2020). Teachers' Computer Literacy in Selected Public Primary Schools in Ainamoi Sub-County in Kericho County, Kenya. *East African Journal of Education Studies*, 2(1), 1-7.
- Ngeno, V.C. & Simatwa E.M.W. (2015). Influence of Free Secondary Education Policy on Dropout Rates in Kenya: A case Study of Kericho County. *Greener Journal of Education Research*. 2015 Vol. 5(4):152-175.
- Ng'eno, B.N., Mweni, M., & Mwoma, T. (2021). Availability of Physical infrastructure in the implementation of CBC IN Public primary schools in Kericho County, Kenya. *Journal of Educational Studies* 3(1),130-146
- Ngozi, D and Salisu H. (2015) Inadequate Laboratory Facilities and Utilization: Pedagogical Hindrance to Students' Academic Performance in Biology in Senior Secondary Certificate Examination in Zaria Metropolis, Kaduna State, Nigeria. *International Business Research*, 8 (9).124-134.
- Ninomiya, A; Nakaya, A; Shimomura, T & Sato, H. (2004). Comparative Study on Competency Based Curriculum (CBC). *The Japanese Journal of Curriculum Studies*, 2004 Volume 13, 45-59.
- Nkya, H.E., Huang, F., & Mwaabungu, F. (2021) Implementation of CBC in Tanzania Perceptions, Challenges and Prospects: A Case of Secondary School Teachers in Arusha Region, Tanzania. *Journal of Education and Practice* 12(19), 34-41
- Nsengimana, V. (2020). Implementation of CBC in Rwanda: Opportunities and Challenges. *Rwandan Journal of Education* 5(1),20-31

- Nwosu, V. (2019). Teachers' perception of the use of language laboratories in English Language teaching and learning in Obio/Akpor Iga. *International Journal of Education and Evaluation*, 5 (1), 31-40.
- Nwosu, C. L., & Nweke, F. N. (2021). Role of playgrounds in the implementation of competency-based curriculum in primary schools in Anambra State, Nigeria. *Journal of Education and Practice*, 12(25), 118-125.
- Nyaboke, R., Kerei, D., & Nyabwari, L.K. (2021). Competency Based Curriculum in and the challenges of Vison 2030. *International Journal of Education Technology and Science* 1(4),15-169.
- Nyoni, Z .K. (2018) Challenges Facing Teachers in Tanzania: the implementation of the paradigm shift towards a competence-based curriculum in public secondary schools in Iringa municipality. *Kervan-International Journal of Afro-Asiatic studies*, 1 (22), 195- 215.
- Ojung'a, N.C. (2023). Influence of teacher preparedness on implementation of CBC in Public Primary Schools in Kikuyu Sub-County, Kenya. *International Journal of Education and Research* 11(1),24-36
- Okafor, P.N. (2000). Difficult concepts in physics as experienced by senior secondary students in Akwa Ibom State. *Journal of Research Information in Education*, 1(1), 114-121.
- Okal, B.O. (2022). Teaching and Assessment of Kenya's indigenous languages in the CBC: Challenges and Way Forward. *A Handbook for Research on Teaching in Multi-Cultural and Multi-lingual Contexts*,463-481
- Okeke, R.J. (1995). Principles of development selection, utilization, evaluation storage and retrieval of instructional materials. In: Okwo, F.A., & Ike, G.A., (Eds.), *Educational Technology: Basic Concepts of Issues*. Nsukka: University Trust Publishers. pp. 45-76.
- Oketch, B. O., & Mogere, J. W. (2021). Availability and utilization of ICT facilities and the implementation of competency-based curriculum in public primary schools in Kenya. *International Journal of Education and Research*, 9(3), 193208.

- Okeyo, S.M., Mokuu, Z.O. (2023). Preparedness of teachers for implementation of CBC Education in Public Secondary Schools in Nyamira Sub-County, Kenya. *East Africa Journal of Education Studies* 6(2),406-418
- Okumu, G.O. (2021). Exploring how head teachers as street level bureaucracy influence the implementation of CBC in Kenya. *East Africa Journal of Education Studies* 3(1),12-21
- Olamijulo, S. K., & Sadiq, A. S. (2021). The role of playgrounds in the implementation of competency-based curriculum in public primary schools in Lagos, Nigeria. *Journal of Education and Practice*, 12(24), 112-118.
- Omariba, A. (2022) Challenges faced by parents in implementation of CBC in Primary Schools: The Kenyan Perspective. *East Africa Journal of Educational Studies* 2(1),33-44
- Omaiyo, J. (2013). Effect of instructional resources on children's number work performance in pre-schools in Isibania Zone, Migori, County (Unpublished Thesis). University of Nairobi, Nairobi.
- Ondieki, J. M., & Masese, M. N. (2021). The influence of play materials and equipment on the implementation of competency-based curriculum in early childhood development centers in Kenya. *International Journal of Education and Practice*, 11(4), 1-11.
- Opondo, O.P., Afwande, J., & Kamau, L.N. (2023). Challenges Facing implementation of CBC in Kenyan Primary Schools: A Case of Kajiado County. *International Journal of Education and Research* 11(1),21-32
- Orina, W.A. (2022). Teachers' preparedness in the implementation of CBC in Science Learning in Public Primary Schools in Nairobi County, Kenya. *International Journal of Education and Research* 10 (1),112-124.
- Orodho, J. A., Langat, J. K., & Kimutai, C. K. (2021). Effects of the digital literacy programme on teachers' competency in the implementation of the competency-based curriculum in Kenya. *Journal of Education and Practice*, 12(10), 74-81

- Ouma, J. A., Okere, M. I., Oduma, E. B., & Ombaba, K. (2021). Assessment of infrastructure and sanitation facilities and their effect on pupils' academic performance in public primary schools in Mbita Sub-County, Homa Bay County, Kenya. *International Journal of Education and Research*, 9(2), 185-196.
- Owuondo. (2023). Disrupting Kenya's Education System: Advancing through Learner Centered Paradigm from Traditional Time-Based Structures. *International Journal of Research and Scientific Innovation (IJRSI)* 10(3)
- Pandita, R. (2012). *Correlational Research*. New Delhi: Web.
- Pareek, R. B. (2019). An Assessment of Availability and Utilization of Laboratory Facilities for Teaching Science at Secondary Level. *Science Education International*, 30 (1), 75- 81.
- Park, M. (2009). Analysis of the characteristics of competence-based curriculum and its critical issues. *Korean Journal of Curriculum Studies*, 27(4), 71–94.
- Paul Okeyo Ogembo. (2025). The Implementation of Competency Based Curriculum in Public Schools in Kenya: Challenges and Opportunities. *Indonesian Journal of Education (INJOE)*, 5(1), 57–77.
- Republic of Kenya. (2015). *Economic Survey 2015*. Nairobi; Government printer.
- Republic of Kenya. (2013). *The Basic Education Act 2013*. Nairobi; Government Printer.
- Republic of Kenya.(2012). *Ministry of Education Sessional Paper No. 14 of 2012, A Policy Framework for Education Training*. Government Printer.
- Republic of Kenya. (2012 b). *Economic Survey 2012*. Nairobi; Government printer.
- Republic of Kenya. (2010). Task force report on the re- alignment of the education sector to the constitution of Kenya 2010:towards a globally competitive quality education for sustainable development Nairobi: Government Press.
- Republic of Kenya. (2010). *2009 Kenya Population and Housing Census*. Nairobi; Government printer.

- Republic of Kenya. (2010a). *2009 Kenya Population and Housing Census*. Nairobi; Government printer.
- Republic of Kenya. (2009). *Guidelines for Implementation of Free Secondary Education*. Nairobi: Ministry of Education.
- Republic of Kenya. (2007). *Report of the Task force on Affordable Secondary Education*. Nairobi: Ministry of Education
- Republic of Kenya. (2006). *Strategic Plan 2006-2012; Nairobi*; Government Printer.
- Republic of Kenya. (2005). *Sessional Paper No.1 of 2005 on A Policy Framework for Education, Training and Research*. Nairobi: Government Printer.
- Rivkin, S. G., Ertik, A., and John, F., (2000). *Teachers, Schools, and Academic Achievement, working paper*. Massachusetts USA: National Bureau of Economic Research.
- Rodney, W., (1994). *How Europe Underdeveloped Africa*. Nairobi: East African Educational Publishers Ltd.
- Rotich, D. C. (2004). The affordability of school textbooks in Kenya: Consumer experiences in the transformation to a liberalizing economy. *Nordic Journal of African Studies*, 13(2), 175-187.
- Rowland, C. (2017). *Principal Professional Development: New Opportunities for a Renewed State Focus*. Education Policy Center at American Institutes for Research.
- Rupia, C. (2022). Teachers' roles in implementation of CBC. *East African Journal of Educational Studies* 5(2),344-350
- Ruto, W. S. (2022, September 30). Presidential working party on education reform. The Kenya Gazette. Retrieved from <https://gazettes.africa/akn/ke/officialGazette/government-gazette/2022-09-30/202/eng@2022-09-30?>
- Santiago, P. (2002). *Teacher Demand and Supply: Improving Teacher Quality and addressing Teacher Shortages*. A literature review and a conceptual

framework for future work. OECD Education Working paper No. 1.
Paris: OECD

- School Leaders Network. (2014). Churn: *The high cost of principal turnover*. Retrieved from http://connectleadsucceed.org/sites/default/files/principal_turnover_cost.pdf
- Secondary Education in Africa. (2001). *At the Crossroads: Choices for Secondary Education in Sub-Saharan Africa*. Washington D.C.: The World Bank.
- Semali, L., & Stambach, A. (1997). Cultural identity in an African context: Indigenous education and curriculum in East Africa. *Folklore Forum*, 28(1), 3–27.
Google Scholar
- Shon, M. H. (2011). The possibility and limits of competence-based curriculum. *The Journal of Korean Education Forum*, 10(1), 101–121
- Sifuna, D. N & Obonyo, M. M. (2019). Competency Based Curriculum in Primary Schools in Kenya - Prospects and Challenges of Implementation. *Journal of Popular Education in Africa*. 3(7), 39 – 50.
- Sifuna, D. N., & Sawamura, N. (2009). Challenges of Quality Education in Sub-Saharan African Countries.
- Simaon, K.D. (2021). Curriculum reform and innovation: Experiences from Kenya’s CBC. *Africa Education Hub*
- Sitenei C. (2020). *School Based Factors Influencing Implementation Of Cbcin Public Primary Schools In Kibera Sub-County, Nairobi City County, Kenya* (Unpublished Masters Project, University Of Nairobi, Kenya)
- Strait, J. R. (2008). Deepening community-based learning through collaboration and assessment. *International Journal on School Disaffection*, 5(2).
<https://doi.org/10.18546/IJSD.05.2.08>
- Stuckey, M., Hofstein, A., Mamlok-Naaman, R., & Eilks, I. (2013). The meaning of ‘relevance’ in science education and its implications for the science curriculum. *Studies in Science Education*, 49, 1-3.
- So, K., Hu, Y. J., & Park, J. (2017). Making our schools more creative: Korea’s efforts and challenges. *International Education Journal: Comparative Perspectives*, 16(4), 77–88.

- So, K.-H. (2007). 'Competency' in the context of schooling: Its meaning and curricular implications. *Korean Journal of Curriculum Studies*, 27(3), 1–21. <https://doi.org/10.15708/kscs.25.3.200709.001>
- So, K., Hu, Y. J., & Park, J. (2017). Making our schools more creative: Korea's efforts and challenges. *International Education Journal: Comparative Perspectives*, 16(4), 77–88.
- Sossion, W. (2019). *KNUT steps up opposition to new curriculum*. The Daily Nation 3rd May 2019. Nation Media Group: Nairobi.
- Spady, W. G. (1977). Competency based education: A bandwagon in search of a definition. *Educational Researcher*, 6(1), 9–14. <https://doi.org/10.3102/0013189X006001009>
- Suberry, L. (2022). Influence of school-based factors on implementation of CBC in Public Primary Schools in Kajiado North Sub-County, Kenya
- Sudsombon, M. (2010). *A Strategy, Implementation and Results of a Flexible Competency Based Curriculum*. ACM New York, NY, USA.
- Syomwene, A. (2013). Factors Affecting Teachers Implantation of Curriculum Reforms and Educational Policies in Schools. The Kenyan Experience. *Journal of Education and Practice*, 4(22), 80 - 86.
- Tingle, E., Corrales, A., Peters, M.L. (2017). Leadership development programs: Investing in school principals. *Educational Studies*. DOI: 10.1080/03055698.2017.1382332.
- Teachers Service Commission. (2005). *Guidelines for recruitment and selection of secondary school teachers*. Nairobi: TSC
- Thonstad, T. (1980). *Analysing and Projecting School Enrolment in Developing Countries: A Manual of Methodology*: Division of Statistics on Education, Unesco Office of Statistics.
- Tuck, R. 2007. *An introductory guide to National Qualifications Frameworks: Conceptual and practical issues for policy makers*. Skills and Employability Department, International Labour Office (ILO). Geneva: ILO.

- Tyler, V. (2020). Enrolment Projections: What methods Work Best? School Districts.
- UNESCO. (2015). Training Tools For Curriculum Development: A Resource Pack (Module 6). Retrieved From [Http://Www.Ibe.Unesco.Org/Fileadmin/User_Upload/Cops/Pages_Documents/Resource_Packs/TTCD/Sitemap/Module_6/Module_6.Html](http://www.ibe.unesco.org/fileadmin/user_upload/Cops/Pages/Documents/Resource_Packs/TTCD/Sitemap/Module_6/Module_6.html). [Links]
- UNESCO Institute of Statistics. (2006). Teachers and Educational Quality: Monitoring Global Needs for 2015. Montreal, Canada: UNESCO Institute of Statistics.
- UNESCO. (2001). *General Secondary School Education in the Twenty-First Century: Trends, Challenges, and Priorities*. Beijing: UNESCO International Expert Meeting on Secondary Schooling.
- UNDP (1999). Human Development Report. Oxford University Press, Oxford.
- UNESCO, Institute for Statistics. (2011). *Financing Education in Sub-Saharan Africa, Meeting the challenges of expansion, Equity, and quality*. Montreal: Canada.
- UNESCO (2011). *Education for All Global Monitoring Report*, UNESCO, Paris.
- UNESCO (2010). *Education for All Global Monitoring Report*, UNESCO, Paris.
- UNESCO (2010). *Education for All Global Monitoring Report*, UNESCO, Paris.
- UNESCO (1999). Statistical Yearbook. UNESCO. Paris.
- United States Agency for International Development (USAID). 1961-2006 “Report of Voluntary agencies” Aid Service, Office of material resources.
- Urunana R. (2018). Implementing CBC: Successes and Challenges. Kigali: Rwanda Issue 006 July, 2018.
- Vavrus, F., Thomas, M., & Bartlett, L. (2011). *Ensuring quality by attending to inquiry: Learner-centred pedagogy in sub-Saharan Africa*. UNESCO: International Institute for Capacity Building in Africa: Addis Ababa.
- Wafubwa, R.N. (2021). Challenges of Teaching and Assessing the 21st Century Competencies in Africa: A focus on the Kenyan New Curriculum of Basic Education. *East African Journal of Educational Studies* 3(1),96-105

- Wambiya, P., & Ogula. (2023). The effectiveness of CBC adoption and implementation in primary and secondary schools in East African Community member states. *East African Journal of Educational Research* 3(1), 23-34
- Wambua, P. M. (2021). The impact of textbook adequacy on the implementation of competency-based curriculum in public primary schools in Kenya. *International Journal of Education and Research*, 9(3), 37-50.
- Wambua, M., & Waweru, S. (2019). Constraints Facing Successful Implementation of the Competency-Based Curriculum in Kenya. *American Journal of Educational Research*, 7(12), 943-947.
- Wanzala, O. (2019). The Daily Nation 3rd May 2019. Nairobi.
- Wanzala, O. (2018). Questions raised on teachers' readiness for new curriculum. *Daily Nation*, July 22, 2018.
- Waruingi, A.W., Mbogo, R. & Mambo, A. (2022). Assessment of strategies employed by head teachers in the implementation of the competency-based curriculum in public primary schools in Kenya: A case of Kiambu County. *African Journal of Emerging Issues*, 4(6), 88 – 104.
- Waweru W. J. (2018). *Influence of Teacher Preparedness on Implementation of Competency-Based Curriculum in Public Primary Schools in Nyandarua North Sub-county, Kenya*. (Doctoral dissertation, university of Nairobi).
- Waweru, J. W. (2018). *Influence of teacher preparedness on implementation of competency based curriculum in public primary schools in Nyandarua North Sub- County, Kenya*. M.Ed. Project, University of Nairobi.
- Wedgwood, R. (2006). "Education and Poverty Reduction in Tanzania, Haki Elimu." Working Paper No. 9. 1 – 18pp.
- Wilkins, E. A. (1974). *Second Language Learning and Teaching*. Hodder Arnold.
- Wongnaa, C.A. & Boachie W. (2018). Perception and Adoption of Competency-based Training by Academicians in Ghana. *International Journal of STEM Education*, vol. 5, no. 52, pp 1-13.

- World Bank (1995). *World Development Report: Workers in an integrating world*. Johns. Hopkins University Press: Baltimore, MD.
- World Bank. (2005). *Expanding Opportunities and Building Competencies for Young People: A New Agenda for Secondary Education*. Washington D.C.: The International Bank for Reconstruction and Development.
- World Bank. (2007). *Secondary Education in Africa: At the Cross Roads: Choices for Secondary Education and training in Sub-Saharan Africa*. Washington D.C.: SEIA and the World Bank.
- World Bank. (2011). A regional exploration of pathways toward harmonization of Mathematics and Science Curriculum in the East African Community. *Discussion Paper*. Washington D.C: World Bank.
- Yoon, J. I., Kim, M. S., Yoon, S. K., & Park, M. J. (2007). The essential characteristics and dimensions of competence as human ability. *Korean Journal of Educational Research*, 45(3), 233–260.
- Yuruk, N., Beeth, M. E., & Andersen, C. (2009). Analyzing the effect of metaconceptual teaching practices on students' understanding of force and motion concepts. *Research in Science Education*, 39(4), 449–475. <https://doi.org/10.1007/s11165-008-9089-6>
- Zee, M., & Koomen, H. M. (2016). Teacher self-efficacy and its effects on classroom processes, student academic adjustment, and teacher well-being: A synthesis of 40 years of research. *Review of Educational Research*, 86(4), 981–1015. <https://doi.org/10.3102/0034654315626801>
- Zeiger, S. (2014). *Role of Teachers in Curriculum Process*. Demand Media.
- Zengele, A. G. and Alemayehu B. (2016). The Status of Secondary School Science Laboratory Activities for Quality Education in Case of Wolaita Zone, Southern Ethiopia. *Journal of Education and Practice*, 7 (31), 1-11
- Zhuwale, C., & Shumba, M. (2017). Factors Limiting Smooth Implementation of New Curriculum in Rural Secondary Schools of Zimbabwe: Case Study Of Nyanga North Area, Zimbabwe. *The International Journal of Humanities and Social Studies*, 6(11), 23 – 36

<https://africacheck.org/wp-content> fees guidelines for secondary schools in Kenya
Downloaded on 14th December 2019.

<https://www.nation.co.ke/news/> education. National Schools to begin admitting day
Scholars. Downloaded on 14th December 2019.<https://www.education.go.ke>
downloaded 15th December 2019.

APPENDICES

APPENDIX I: HEAD TEACHER'S QUESTIONNAIRE

PROJECTION MODELS FOR SELECTED REQUIREMENTS IN THE IMPLEMENTATION OF COMPETENCY BASED CURRICULUM IN SENIOR SECONDARY SCHOOLS IN KENYA.

THIS QUESTIONNAIRE SHOULD BE ADMINISTERED TO THE HEAD TEACHERS IN RANDOMLY SAMPLED PRIMARY SCHOOLS IN VIHIGA COUNTY

SECTION 1: INTRODUCTION AND CONSENT

Head teacher's consent

Good morning/afternoon/evening sir/madam. My name is (NAME) . I am a research assistant carrying out research on projecting enrolment and requirements for the implementation of competency-based curriculum in senior secondary schools in Vihiga County, Kenya. Your school was randomly sampled to participate in the study, and I visit you today to seek your consent to collect data on enrolment, teacher establishment and infrastructure, among others. These data are for academic purposes only. Summary statistics will be used, and no names of schools or respondents will be made known. I have the necessary research permits and letters of introduction from relevant offices and now seek your consent for the data study and data requested. (SHOW RESPONDENT THE DOCUMENTS).

All data will be held with utmost confidentiality and will only be available to the Principal Researcher. Your responses will not cause you and your school any disadvantage. If you accept to participate in the study, you will be doing so professionally and voluntarily and there will not be any monetary returns. Any benefits of the research will be policy oriented intended to inform planning for smooth implementation of the CBC curriculum. You are free to ask questions as we proceed. You may also opt not to respond to questions you do not feel comfortable answering. This interview will take about 30 minutes. Please feel free to contact the Principal Researcher, Dorothy Sagwa, Tel. +254722291919; Email: dorothisagwa@gmail.com should you have questions you would like clarified or for further information about the study.

1.1 Do you give consent to participate in the study? 1=YES; 2=NO

[IF 1=YES, THANK YOU VERY MUCH. NOW PLEASE PROCEED AND COMPLETE THE QUESTIONNAIRE]

[IF 1.1=2, KINDLY ANSWER

1.2. Kindly let me know the reason why you would not wish to participate in this research

1=TOO BUSY/DO NOT HAVE TIME;2=TIRE OF RESEARCH; 3=RESEARCH

NOT BENEFICIAL; 4=NOT INTERESTED; 96=OTHER (specify)

1.3 FOR USE BY PRINCIPAL RESEARCHER

QUESTIONNAIRE ID

SECTION 2: SCHOOL ENROLMENT TRENDS

Kindly fill in the spaces, the total grade enrolment statistics for the years and grades listed.

[INDICATE 0 (ZERO) IN THE SPACES IF THERE WERE NO REPEATERS, DROPOUTS, OR TRANSFERS]

YEAR		Grade 1	Grade 2	Grade 3	Grade 4	Grade 5
2017	Enrolment					
	Repeaters					
	Drop-outs					
	In-transfers					
	Out-transfers					
	Deaths					
2018	Enrolment					
	Repeaters					

	Drop-outs					
	In-transfers					
	Out-transfers					
	Deaths					
2019	Enrolment					
	Repeaters					
	Drop-outs					
	In-transfers					
	Out-transfers					
	Deaths					
2020	Enrolment					
	Repeaters					

	Drop-outs					
	In-transfers					
	Out-transfers					
	Deaths					
2021	Enrolment					
	Repeaters					
	Drop-outs					
	In-transfers					
	Out-transfers					
	Deaths					

3.1 What is today date? Day.....Month..... Year.....

3.2 What is the full name of your school?

.....

3.3 In which sub county is your school? 1=SABATIA; 2=VIHIGA; 3=HAMISI;
4=EMUHAYA; 5=LUANDA

3.4 When was your school established/ started? (DD/MM/YYYY)

.....

3.5 What is your school type? 1=BOYS ONLY; 2=GIRLS ONLY; 3=MIXED BOYS
AND GIRLS

3.6 What is your school classification? 1=BOARDING; 2=DAY; 3=MIXED
BOARDING AND DAY

3.7 Is your school private or public? 1=PRIVATE; 2=PUBLIC

.....

SECTION 4: DATA ENTRY

4.1 DATA ENTRY CLERK'S NAME AND CODE

.....

Thank you very much for completing the questionnaire.

APPENDIX 2: PRINCIPALS' QUESTIONNAIRE

I am a PhD student at Masinde Muliro University of Science and Technology conducting research on 'Modelling Projections of the Selected Requirements for the Implementation of Competency Based Curriculum in Senior Secondary Schools Kenya.' The questionnaire seeks information on modelling projections for the selected requirements in the implementation of CBC at Senior Secondary schools in Kenya. Careful, complete and honest responses will assist in collecting valid data. This questionnaire has two sections, A and B. Kindly answer the questions as honestly as possible. All information shall be kept confidential. Do not write your name or the name of the school.

Thank you for your co-operation.

A. School information

1. Name of school? _____
2. County _____
3. Sub-county _____
4. Ward _____ Location _____
5. Name of sponsor _____
6. Status: Public _____ Private _____
7. What is the category of school? **Code** [____]

	Public	Private
Mixed Day	1	10
Mixed Boarding	2	11
Mixed Day and Boarding	3	12
Girls' day	4	13
Girls' Boarding	5	14

Girls' Day and Boarding	6	15
Boys' Day	7	16
Boys' Boarding	8	17
Boys' day and Boarding	9	18

Other (specify) [96].....

8. When was it started? _____

B. Bio Data (Personal Information)

1. When were you appointed the principal of this school. [D.....M.....Y.....]
2. What is your highest level of education? **Code** [_____]

Level Code

Diploma [1]

Degree [2]

Masters [3]

PhD [4]

Other (specify) [96].....

3. What is your gender? Code [____] Male [1] Female [2]
 4. Indicate your date of birth. [D..... M..... Y.....]

C. Student Enrolment

1. Indicate student enrolment from 2017 to 2021 as follows.

Year	Enrolment PWD	Enrolment Boys	Enrolment Girls	Total
Grade 5 2021				
Grade 42020				
Grade 3 2019				
Grade2 2018				
Grade1 2017				
Total				

2. Indicate streams in the school from 2017 to date.

Year	Streams grade 1	Streams grade 2	Streams grade 3	Streams grade 4
2021				
2020				

2019				
2018				
2017				

D. Staff establishment

1. Indicate your current teacher establishment for TSC Teachers only.

Year	Male teachers	Female teachers	Total
2021			
2020			
2019			
2018			
2017			

2. Indicate your non-teaching staff establishment as follows.

Year	Male	Female	Total
2021			
2020			
2019			

2018			
2017			

3. How many teachers are allocated to teach the following grades in your school?

Grade 1.....

Grade 2.....

Grade 3.....

Grade 4.....

4. Have your teachers attended any in-service training with regard to the Competency Based Curriculum? **Code** [____]

Yes [1] No [2]

5. If yes, how long was the training? **Code** [____]

One week [1]

Two weeks [2]

Three weeks [3]

More than four weeks [4]

6. How often is the training? **Code** [____]

Monthly [1]

Termly [2]

Yearly [3]

7. Are your teachers competent in all the subject areas they teach? **Code** [____]

Yes [1] No [2]

2017 School Infrastructure

1. Number of laboratories available _____
2. Capacity of the Labs _____
3. How many streams is your school? **Code** [____]

One [1] Two [2]

Three [3] Four [4]

Five [5] Six [6]

Other (specify) [96]

4. Indicate by use of a tick the availability of approved and standard permanent classrooms in your school. **Code** [____]

Yes [1] No [2]

5. If yes, what is the total number of approved and standard permanent classrooms in your school?

.....

6. How many students do you have per class? **Code** [____]

Number Code

20-30 [1]

31-40 [2]

41-50 [3]

51-60 [4]

61-70 [5]

Other (specify) [96].....

7. Indicate the Capacity of each laboratory as follows.

S/No	Name of laboratory	Size	Capacity	Status of facilities eg adequate/inadequate
01	Physics			
02	Chemistry			
03	Biology			
04	Music			
05	Language			
06	Sports			

8. Indicate availability of ICT infrastructure in the school. (Code ___)
Yes[1] No [2]

9. Are ICT facilities sufficient? (Code _____) Yes[1] No [2]

10. Indicate availability of ICT facilities as follows.

S/No	Name of ICT facility	Condition	Capacity	Number
01	ICT lab			
02	LCD Projector			
03	White Board			
04	Internet			
05	Laptops			
06	Computers			
07	Presentation rooms			
08	Others			

11. Indicate on-going projects as follows.

S/No	Project	Approved cost estimate	Amount spent	status	Estimated completion
01	School bus				
02	School van				
03	Classrooms				
04	Administration block				
05	Dining hall				
06	Playground				

07	Land purchase				
08	Toilet				
09	Labs				
10	Any others				

8. Does your school have an approved School development plan? Yes [] No []

9. Provide date of approval [] Name of approving officer _____

10. If yes which form _____

2018 Subsidised Secondary Education Capitation.

1. How much money is given to each student for the subsidized secondary education funding?

Enrolment	Boys	Girls	Total capitation	Deficit	Overpayment
2021					
2020					
2019					
2018					
2017					

2019CBC implementation

5. Have you received any in-service training in readiness for the implementation of CBC in the year 2024 at junior secondary level?

Yes [1] No [2]

8. Have your teachers attended any in-service training with regard to the Competency Based Curriculum?

Yes [1] No [2]

9. If yes, how long was the training? **Code** [____]

One week [1]

Two weeks [2]

Three weeks [3]

More than four weeks [4]

10. If yes for 15, how often is the training? **Code** [____]

Monthly [1]

Termly [2]

Yearly [3]

Thank you for participating.

APPENDIX 4: Observation Schedule

This observation schedule is meant to collect data on the number and state/condition of physical facilities in schools within Vihiga County.

School.....

Type of school: Mixed..... Boys only..... Girls only

Boarding only..... Both day and boarding.....

Serial No.	Infrastructural facility	Number Available	Condition	Comment/ Suitability	Shortfall/ Number required.
01	Classrooms				
02	Libraries				
03	Laboratories				
04	Toilets /latrines				
05	Dormitories				
06	Technical Facility				
07	Dining				