# Implementation Gaps in the Competency-Based Curriculum for Mathematics and Science Subjects: Evidence from Secondary Schools in Kabwe District, Zambia

**Kunda Allan Cephas[1],Sinyangwe Maureen Kanchebele[2], Ng'ambi Richard[3]**

**Kwame Nkrumah University, Zambia**

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## ABSTRACT

The Competency-Based Curriculum (CBC) was introduced in Zambia to enhance learners' acquisition of practical skills, critical thinking, and problem-solving abilities. However, its implementation in Mathematics and Science subjects has presented significant challenges at school level. This study examined the implementation gaps in the CBC for Mathematics and Science subjects in secondary schools in Kabwe District, Zambia. A mixed-methods descriptive research design was employed. Quantitative data were collected using questionnaires administered to Mathematics and Science teachers, while qualitative data were obtained through interviews with Heads of Department and school administrators. The study focused on teacher preparedness, availability of instructional resources, assessment practices, and alignment between CBC policy expectations and classroom practice. Quantitative data were analysed using descriptive statistics, while qualitative data were analysed thematically. The findings revealed limited teacher preparedness, inadequate teaching and learning resources, challenges in competency-based assessment, class size, and inconsistencies in translating CBC policy into effective classroom practice. These gaps hinder the effective implementation of the CBC in Mathematics and Science subjects. The study concludes that targeted professional development, improved resource provision, and clearer curriculum and assessment guidelines are essential to strengthening CBC implementation. The findings provide evidence-based insights to inform teachers, school administrators, and curriculum developers on strategies for improving the implementation of the Competency-Based Curriculum.

**Keywords:** Competency-Based Curriculum; Mathematics Education; Science Education; Implementation Gaps; Teacher Preparedness; Z

## INTRODUCTION

### Overview

Chapter One introduces the study by situating the Competency-Based Curriculum (CBC) within global and national education reforms, with specific reference to Zambia's 2023 Education Curriculum Framework and its implications for Mathematics and Science education. The chapter outlines the problem of implementation gaps between CBC policy expectations and classroom practice, particularly in relation to teacher preparedness, instructional resources, assessment practices, and institutional support in secondary schools in Kabwe District. It further presents the purpose of the study, research objectives and questions, significance, scope, limitations, and the conceptual framework guiding the investigation, thereby establishing the foundation for examining how these gaps affect effective CBC implementation and informing curriculum improvement.

### Background of the Study

Across the world, competency-based curriculum (CBC) reforms have been adopted to shift schooling from coverage of content to demonstrable mastery of knowledge, skills, values, and attitudes that learners can apply in real-life contexts. In Zambia, this shift has intensified with the move from the earlier outcomes-based orientation toward a competence-based curriculum, with an emphasis on learner-centred pedagogy, practical skills, and continuous assessment (Mulenga, I. M., & Kabombwe, Y. M.,2019).

The Ministry of Education, through the Curriculum Development Centre (CDC), validated the 2023 Zambia Education Curriculum Framework (ZECF) in December 2023, signalling a renewed national commitment to competency-based education and alignment to national development priorities. In parallel, assessment reforms and supporting guidance documents have continued to emphasise stronger links between formative and summative assessment and learning outcomes or competencies.

Despite the clarity of the policy direction, evidence from Zambia and comparable contexts suggests that curriculum reforms often experience implementation gaps due to limited teacher preparedness, inadequate resources, inconsistent assessment practices, and weak school-level support systems. For example, studies on Zambia's curriculum reforms report challenges related to teacher readiness and pedagogical adaptation to competence-based expectations (Oliver, M., Peggy, M., Colious, G., Situmbeko, M., & Christine, K., 2021). The Mathematics and Science subjects are particularly sensitive to these gaps because CBC expectations require practical investigations, problem-solving, inquiry-based learning, and competency-aligned assessment approaches that demand resources, specialised teacher capacity, and supportive school conditions (Daka, H., 2024).

Kabwe District provides a suitable setting for examining these gaps because it includes schools with diverse contexts (urban and peri-urban), varying resourcing levels, and different teacher professional development exposures. Generating district-level evidence can therefore provide actionable insights for teachers and school leaders (implementers), and for curriculum developers and assessment bodies (system actors) responsible for refining guidance, training, and curriculum instruments.

**Statement of the Problem**

The 2023 ZECF positions CBC as a pathway for developing learners' competencies, including problem-solving, critical thinking, and practical application of knowledge. However, early evidence in Zambia indicates that full implementation is constrained by insufficient teacher preparedness, uneven access to instructional materials, and uncertainty or inconsistency in competency-based assessment practices (Fidelis, C., Sudarsanam, D., & Chelliah, R., 2025).

In Mathematics and Science subjects, these constraints may produce a visible policy–practice gap: the curriculum expects competency development through learner-centred and activity-based pedagogy, yet classroom realities may remain teacher-centred, examination-driven, and resource-limited. Research on earlier phases of Zambia's curriculum reforms also points to pedagogical and readiness challenges among secondary teachers (Oliver, M., Peggy, M., Colious, G., Situmbeko, M., & Christine, K., 2021).

Without district-specific evidence on how these gaps manifest in Mathematics and Science classrooms especially in relation to teacher preparedness, resources, assessment, and school support curriculum developers and implementers may lack the practical feedback needed to strengthen CBC delivery. This study therefore investigates the implementation gaps in CBC for Mathematics and Science subjects in secondary schools in Kabwe District.

**Purpose of the Study**

The purpose of this study is to examine implementation gaps in the competency-based curriculum for Mathematics and Science subjects in secondary schools in Kabwe District, Zambia, in order to generate evidence-based recommendations for improving implementation and informing curriculum and assessment refinement.

**Research Objectives**

**General Objective**

To examine implementation gaps in the competency-based curriculum for Mathematics and Science subjects in secondary schools in Kabwe District, Zambia, and derive implications for strengthening curriculum implementation and reform.

**Specific Objectives**

The objectives of the study are;

1. To assess the level of teacher preparedness for implementing the Competency-Based Curriculum in Mathematics and Science subjects in secondary schools in Kabwe District.
2. To examine the availability and adequacy of instructional resources, assessment practices, and institutional support for the implementation of the CBC in Mathematics and Science.
3. To identify challenges and mismatches between CBC policy expectations and classroom practices in Mathematics and Science subjects and propose strategies to inform curriculum improvement.

**Research Questions**

1. What is the level of teacher preparedness for implementing CBC in Mathematics and Science subjects in Kabwe District secondary schools?
2. How adequate are instructional resources, CBC-aligned assessment practices, and school-level institutional support for CBC implementation in Mathematics and Science?
3. What key policy practice gaps exist in Mathematics and Science CBC implementation, and what strategies can be recommended to inform curriculum improvement?

**Significance of the Study**

The study is significant to the following;

A. Teachers of Mathematics and Science: Findings highlights priority areas for professional development in learner-centred pedagogy, competency-based lesson design, and classroom-based assessment practices aligned to CBC intentions.
B. School Management (Headteachers/HODs): The study provides evidence on school-level supports needed such as timetabling for practical work, internal CPD structures, departmental planning, and resource mobilisation to strengthen CBC delivery.
C. Curriculum Developers (CDC) and MoE: The findings offer grounded feedback on how curriculum intentions are interpreted and enacted in classrooms, informing refinement of teacher guidance, curriculum clarity, and implementation support packages.
D. Assessment Bodies (ECZ) and Policymakers: Evidence on assessment challenges inform improvements to assessment frameworks and teacher support on competency-based assessment, helping reduce misalignment between teaching, learning, and assessment demands.
E. Researchers: The study contributes to the Zambian and regional evidence base on CBC implementation in STEM-related subjects and district-level education reform implementation.

**Scope of the Study**

Content scope: The study focuses on CBC implementation in Mathematics and Science subjects teaching approaches, learning resources, assessment practices, and institutional support.

Geographical scope: The study is confined to selected secondary schools in Kabwe District, Central Province, Zambia.

Target participants: Mathematics and Science teachers, Heads of Department, and selected school administrators; where relevant, district education standards and subject officials may provide key-informant perspectives.

**Delimitations of the Study**

The study is delimited to Secondary schools in Kabwe District and the focus is on Mathematics and Science subjects.

**Limitations of the Study**

Potential limitations include:

1. Self-report bias in questionnaires and interviews.
2. Unequal exposure to CBC training among teachers, which may affect comparability.
3. Learner perspectives were not included in this phase of the study; future research should incorporate learner experiences and outcomes to provide a more comprehensive evaluation of CBC effectiveness.

To mitigate the limitations, triangulation (questionnaires + interviews), anonymised responses, and careful sampling across different school contexts were utilized.

## CONCEPTUAL FRAMEWORK

The study was guided by a policy-to-practice implementation logic in which CBC policy expectations (competency outcomes, learner-centred pedagogy, and competency-based assessment) require enabling inputs and processes to achieve desired classroom practices and learner competencies. Key constructs include:

A. Teacher preparedness (training, curriculum literacy, pedagogical content knowledge for competency-oriented teaching) influences how teachers interpret and implement CBC.
B. Resources and institutional support (teaching/learning materials, laboratory/practical facilities, administrative support, departmental planning) shape feasibility of inquiry-based and practical learning in Mathematics and Science.
C. Assessment practices (formative assessment, classroom-based assessment, alignment of tasks to competencies) influence what teachers teach and what learners practice, thereby shaping competency development.

Implementation gaps are conceptualised as misalignments between intended CBC practices and enacted classroom realities, producing weakened competency acquisition and reduced effectiveness of the reform.

**Definition of Key Terms**

a) Competency-Based Curriculum (CBC): A curriculum approach that emphasises learners' ability to demonstrate application of knowledge, skills, values, and attitudes in authentic contexts, rather than only content recall.
b) Implementation gaps: Differences between policy intentions (official curriculum expectations) and actual classroom practices and conditions.
c) Teacher preparedness: The extent to which teachers possess adequate training, knowledge, confidence, and pedagogical capacity to implement CBC effectively.
d) Competency-based assessment: Assessment practices designed to capture evidence of competency mastery (including formative and classroom-based assessment aligned to learning outcomes/competencies).

## SUMMARY

Chapter One established the contextual and conceptual foundation of the study by outlining the background to the implementation of the Competency-Based Curriculum (CBC) in Zambia, with particular emphasis on Mathematics and Science subjects in secondary schools. The chapter highlighted the shift towards competency-based education and the policy intentions embedded in the 2023 Zambia Education Curriculum Framework, alongside the emerging challenges in translating these intentions into effective classroom practice. The problem statement identified key implementation gaps related to teacher preparedness, availability of instructional and learning resources, assessment practices, and institutional support systems. The chapter also presented the purpose, objectives, and research questions guiding the study, as well as the significance of the research to teachers, school administrators, curriculum developers, and policymakers. Finally, the scope, limitations, and conceptual framework were outlined to clarify the focus and direction of the study.

# LITERATURE REVIEW

### Overview

This chapter reviews related literature on the implementation of the Competency-Based Curriculum (CBC), with specific focus on Mathematics and Science subjects at secondary school level. The review is organised around the key themes guiding the study, namely teacher preparedness, instructional resources and assessment practices, and policy–practice gaps in CBC implementation. International literature is reviewed to provide a global perspective on competency-based education, while regional and local studies are examined to contextualise the discussion within Zambia's education system. The chapter concludes by identifying gaps in the existing literature that justify the current study.

# THEORETICAL FRAMEWORK

This study is anchored in Fullan's Theory of Educational Change (2016) and Rogan and Grayson's Theory of Curriculum Implementation (2003). Together, these frameworks provide a robust lens for understanding why curriculum reforms such as the Competency-Based Curriculum (CBC) often experience implementation gaps, particularly in technically demanding subjects like Mathematics and Science.

### Fullan's Theory of Educational Change

Fullan's Theory of Educational Change explains educational reform as a complex, multi-level process rather than a single event. According to Fullan (2016), successful implementation of curriculum reforms depends on three interrelated dimensions:

A. Changes in materials (curriculum documents, teaching resources),
B. Changes in teaching practices (pedagogy, assessment), and
C. Changes in beliefs and understanding (teachers' attitudes, curriculum literacy).

Fullan emphasises that reforms fail when teachers are expected to implement new curricula without adequate professional development, support, and clarity. In the context of CBC, Mathematics and Science teachers are required to adopt learner-centred approaches, inquiry-based learning, and competency-based assessment practices that represent a significant shift from traditional content-driven instruction. If teachers lack sufficient understanding of CBC principles or feel unsupported, implementation becomes superficial or inconsistent.

This theory is particularly relevant to the current study because it explains how teacher preparedness, availability of resources, and institutional support directly influence the translation of CBC policy into classroom practice. Fullan's framework therefore informs the study's focus on preparedness, resources, assessment practices, and school-level support as key determinants of implementation gaps.

### Rogan and Grayson's Theory of Curriculum Implementation

Rogan and Grayson's Theory of Curriculum Implementation (2003) complements Fullan's work by focusing specifically on contextual realities within schools, particularly in developing-country settings. The theory proposes that curriculum implementation is influenced by two broad factors:

A. School capacity to support innovation, and
B. Levels of implementation of curriculum practices.

School capacity includes factors such as teacher expertise, availability of teaching and learning resources, leadership support, and professional collaboration. Rogan and Grayson argue that schools differ significantly in their readiness to implement reforms, and expecting uniform implementation across contexts is unrealistic.

The theory also introduces the idea of implementation as a gradual process, where schools move through different levels of enactment rather than instantly achieving full compliance with curriculum expectations. This perspective is especially useful for analysing CBC implementation in Mathematics and Science, where

practical work, experimentation, and continuous assessment require varying degrees of infrastructure, equipment, and pedagogical support.

In the Zambian context, where schools differ in resourcing and teacher exposure to CBC training, Rogan and Grayson's framework helps explain why implementation gaps persist despite clear national policy directives.

**Relevance of the Theoretical Framework to the Study**

The integration of Fullan's and Rogan and Grayson's theories provides a comprehensive framework for analysing CBC implementation gaps in Mathematics and Science subjects. Fullan's theory highlights the change process and the importance of teacher understanding and support, while Rogan and Grayson's framework foregrounds school-level capacity and contextual constraints.

Together, these theories guide the study in:

a) Examining how teacher preparedness influences CBC implementation in Mathematics and Science;
b) Analysing how resource availability, assessment practices, and institutional support shape classroom practice; and
c) Interpreting observed gaps between CBC policy expectations and actual classroom enactment.

By grounding the study in these theoretical perspectives, the research moves beyond merely describing challenges to offering theoretically informed explanations and recommendations for strengthening CBC implementation and informing curriculum reform.

**Conceptualising Competency-Based Curriculum**

Competency-Based Curriculum is grounded in the idea that learning should be measured by learners' ability to apply knowledge, skills, values, and attitudes in authentic contexts rather than by content coverage alone. CBC emphasises learner-centred pedagogy, integration of theory and practice, continuous assessment, and mastery of competencies (Mulenga & Kabombwe, 2019; UNESCO, 2017). In Mathematics and Science education, CBC promotes inquiry-based learning, problem-solving, experimentation, modelling, and real-world applications.

Globally, CBC reforms have been implemented in countries such as Finland, Rwanda, Kenya, and Singapore, where curriculum frameworks prioritise competencies such as critical thinking, collaboration, creativity, and scientific reasoning (OECD, 2018; UNESCO, 2017). However, studies consistently show that successful implementation depends heavily on teacher competence, clarity of curriculum documents, availability of resources, and alignment between teaching and assessment (Priestley et al., 2021).

In Zambia, the CBC approach is embedded in the Zambia Education Curriculum Framework (ZECF), with the latest validation conducted in 2023. The framework emphasises practical skills, learner-centred instruction, integration of cross-cutting issues, and competency-based assessment across learning areas, including Mathematics and Science (Ministry of Education, 2023).

## CONCEPTUAL FRAMEWORK

The conceptual framework for this study illustrates the relationships among key factors influencing the implementation of the Competency-Based Curriculum (CBC) in Mathematics and Science subjects in secondary schools in Kabwe District. It is derived from the study objectives and informed by Fullan's Theory of Educational Change and Rogan and Grayson's Theory of Curriculum Implementation.

In this study, CBC policy expectations for Mathematics and Science such as learner-centred pedagogy, inquiry-based learning, practical activities, and competency-based assessment form the independent policy input. The effective translation of these expectations into classroom practice is mediated by three major interacting variables: teacher preparedness, instructional resources and institutional support, and assessment practices.

Teacher preparedness includes teachers' curriculum literacy, subject and pedagogical competence, exposure to CBC training, and attitudes towards competency-based teaching and assessment. Well-prepared teachers are more likely to design learner-centred lessons, integrate practical and inquiry-based activities, and apply appropriate assessment strategies in Mathematics and Science classrooms.

Instructional resources and institutional support refer to the availability of teaching and learning materials (such as textbooks, laboratory equipment, ICT tools, and manipulatives), as well as administrative support, time allocation, departmental collaboration, and professional development opportunities. Adequate resources and supportive school leadership enhance teachers' capacity to implement CBC requirements effectively.

Assessment practices focus on the alignment of classroom-based assessment with CBC principles, including formative assessment, performance tasks, projects, and continuous feedback. When assessment practices are not aligned to competencies, teachers tend to revert to traditional examination-oriented instruction, thereby weakening CBC implementation. These mediating variables collectively influence the level of CBC implementation in Mathematics and Science classrooms. Where teacher preparedness is limited, resources are inadequate, or assessment practices are poorly aligned, implementation gaps emerge between CBC policy intentions and actual classroom practice. These gaps ultimately affect the outcomes of CBC implementation, including the development of learners' mathematical reasoning, scientific inquiry skills, problem-solving abilities, and application of knowledge.

The framework also recognises the influence of contextual factors such as school location, class size, and teacher workload, which may moderate the relationships among the variables. The interaction of these elements informs the study's analysis of implementation gaps and guides the formulation of recommendations aimed at improving CBC implementation and informing curriculum reform.

**Teacher Preparedness for CBC Implementation in Mathematics and Science**

Teacher preparedness is a critical determinant of effective curriculum implementation. It encompasses teachers' understanding of CBC principles, pedagogical skills, subject-matter knowledge, assessment competence, and attitudes toward curriculum reform (Fullan, 2016; Mulenga & Kabombwe, 2019).

International studies indicate that many teachers struggle to shift from traditional teacher-centred methods to learner-centred, competency-based approaches, particularly in Mathematics and Science subjects that demand practical activities and inquiry-based pedagogy (Darling-Hammond et al., 2019). Inadequate professional development and limited curriculum literacy have been identified as major barriers.

In Zambia, several studies report similar concerns. Research conducted by Kabombwe (2018) and Daka (2024) found that secondary school teachers often lacked adequate training to interpret competency-based learning outcomes and design appropriate classroom activities and assessments. Studies focusing on science education revealed difficulties in implementing school-based assessments due to limited teacher capacity and unclear assessment guidelines (Daka, 2024).

Recent studies following the introduction of the 2023 ZECF further indicate that many Mathematics and Science teachers have received minimal in-service training, resulting in partial or superficial implementation of CBC principles (Mukuka et al., 2023). These findings suggest that teacher preparedness remains a major implementation gap, particularly in technical subjects that require specialised pedagogical skills.

**Instructional Resources and Institutional Support**

The availability of instructional resources is essential for the effective implementation of CBC, especially in Mathematics and Science, where practical activities, experiments, and modelling are central to competency development. Resources include textbooks, laboratory equipment, ICT tools, manipulatives, and teaching guides.

Studies across Sub-Saharan Africa show that resource inadequacy significantly constrains CBC implementation (UNESCO, 2019). In Kenya and Rwanda, despite strong policy commitment to CBC, schools

face challenges related to overcrowded classrooms, limited laboratories, and insufficient teaching materials (Orodho et al., 2020).

In Zambia, research indicates persistent disparities in resource distribution across schools. Mulenga and Kabombwe (2019) argue that curriculum reforms have often been introduced without corresponding investment in teaching and learning materials. Studies conducted in Lusaka and Central Provinces reveal shortages of laboratory equipment, limited access to ICT, and inadequate Mathematics teaching aids, which hinder practical and inquiry-based instruction (Mukuka et al., 2023).

Institutional support, including school leadership, departmental collaboration, and time allocation for planning, also plays a crucial role. Headteachers and Heads of Department influence curriculum implementation through supervision, professional learning communities, and resource mobilisation. However, studies suggest that many school leaders are themselves still adjusting to CBC requirements, limiting their capacity to support teachers effectively (Daka & Changwe, 2022).

**Assessment Practices under the Competency-Based Curriculum**

Assessment is a central component of CBC, as it provides evidence of learners' competency acquisition. Competency-based assessment emphasises formative assessment, performance tasks, projects, portfolios, and continuous feedback rather than reliance on summative examinations alone (OECD, 2018).

International literature highlights persistent challenges in aligning assessment practices with competency-based learning outcomes, particularly in examination-oriented systems (Darling-Hammond et al., 2019). Teachers often struggle to design valid and reliable assessment tools that capture complex competencies.

In Zambia, the Examinations Council of Zambia (ECZ) has begun aligning assessment frameworks with the ZECF, but studies indicate that classroom-based assessment practices remain inconsistent. Daka (2024) reports that Science teachers experience difficulties implementing school-based assessments due to limited training and unclear assessment rubrics. Similar concerns have been reported in Mathematics education, where teachers continue to prioritise procedural knowledge and examination preparation over competency development (Mukuka et al., 2023). These challenges contribute to misalignment between teaching, learning, and assessment, thereby weakening the intended outcomes of CBC implementation.

**Policy Practice Gaps in CBC Implementation**

Policy practice gaps refer to discrepancies between curriculum intentions and actual classroom practices. Curriculum implementation literature consistently demonstrates that well-designed policies do not automatically translate into effective practice (Fullan, 2016; Priestley et al., 2021).

In Zambia, studies on earlier curriculum reforms revealed gaps arising from limited teacher involvement in curriculum design, inadequate communication of policy expectations, and insufficient implementation support (Kabombwe, 2018). Emerging evidence suggests that similar gaps persist in the current CBC implementation, particularly in Mathematics and Science subjects where curriculum demands are high and support structures remain weak.

District-level studies are particularly scarce, yet they are crucial for understanding how national policies are enacted in diverse school contexts. This gap in localized empirical evidence underscores the need for district-focused studies such as the present research in Kabwe District.

**Empirical Research Gaps**

From the reviewed literature, several gaps are evident. First, while numerous studies examine CBC implementation broadly, few focus specifically on Mathematics and Science subjects at secondary school level. Second, limited research provides district-level evidence that captures contextual realities influencing implementation. Third, there is insufficient integration of teacher preparedness, resources, assessment, and policy–practice alignment within a single study. This study seeks to address these gaps by providing empirical

evidence on implementation gaps in CBC for Mathematics and Science subjects in secondary schools in Kabwe District, Zambia.

### Summary

Chapter Two reviewed theoretical and empirical literature on competency-based curriculum implementation, with emphasis on teacher preparedness, instructional resources, assessment practices, and policy–practice gaps. The review highlighted persistent challenges in implementing CBC in Mathematics and Science subjects both globally and locally, and identified gaps in district-level empirical research. These gaps justify the current study and provide a foundation for the research methodology presented in Chapter Three.

## METHODOLOGY

### Overview

Chapter Three outlines the research methodology adopted for the study. It describes the research design, target population, sample size and sampling procedures, data collection instruments, data collection procedures, data analysis methods, and ethical considerations. The chapter explains how quantitative and qualitative data were collected from Mathematics and Science teachers, Heads of Department, headteachers, and Standards and Evaluation Senior Education Officers in selected secondary schools in Kabwe District, and how document review was used to complement primary data sources. This methodological framework provides a systematic approach for examining implementation gaps in the Competency-Based Curriculum for Mathematics and Science subjects.

### Research Design

The study adopted a mixed-methods descriptive research design. This design was considered appropriate because it enabled the collection of both quantitative and qualitative data to provide a comprehensive understanding of implementation gaps in the Competency-Based Curriculum (CBC) for Mathematics and Science subjects. Quantitative data provided measurable evidence on teacher preparedness, availability of resources, and assessment practices, while qualitative data offered in-depth insights into school- and district-level experiences influencing CBC implementation. The integration of the two approaches enhanced triangulation and strengthened the credibility of the findings.

### Target Population

The target population comprised all secondary school Mathematics and Science teachers, Heads of Department (Mathematics and Science), Headteachers, and Standards and Evaluation Senior Education Officers (SESOs) responsible for Mathematics and Science subjects in Kabwe District. These participants were selected because they play direct and strategic roles in the implementation, supervision, and evaluation of the CBC at classroom, departmental, school, and district levels.

### Sample Size and Composition

A total sample of forty-seven (47) participants was selected from ten (10) secondary schools in Kabwe District. The sample composition was as follows:

| **Category** | **Number** |
|---|---|
| Mathematics Teachers | 10 |
| Science Teachers | 10 |
| HOD Mathematics | 10 |
| HOD Science | 10 |
| Headteachers | 5 |
| SESOs (Mathematics and Science) | 2 |
| **TOTAL** | **47** |

This sample size was considered adequate for a district-level mixed-methods study and sufficient to capture varied perspectives on CBC implementation across Mathematics and Science subjects.

**Sampling Techniques and Procedures**

Purposive sampling was used to select ten secondary schools that were actively implementing the Competency-Based Curriculum and represented different school contexts, including urban and peri-urban settings. Within each selected school, one Mathematics teacher and one Science teacher were purposively selected based on their involvement in teaching CBC-aligned classes. Heads of Department for Mathematics and Science were selected through total inclusion because of their leadership and supervisory roles within departments. Five headteachers were purposively selected from the ten schools to provide school-level leadership perspectives, while both the Mathematics and Science SESOs were included through total population sampling, as they are key informants at district level.

**Data Collection Instruments**

The study utilised four data collection instruments:

**Teacher Questionnaire**

A structured questionnaire was administered to Mathematics and Science teachers using Google Forms. The questionnaire contained closed-ended items and a few open-ended questions focusing on teacher preparedness, instructional resources, assessment practices, and perceived implementation challenges.

**Semi-Structured Interview Guide**

Semi-structured interview guides were used to collect qualitative data from Heads of Department, headteachers, and SESOs. The interviews explored issues related to departmental support, school leadership, monitoring, professional development, assessment practices, and policy practice gaps in CBC implementation.

**Document Review Checklist**

A document review checklist was used to examine relevant documents that support CBC implementation. These documents included:

A. Zambia Education Curriculum Framework (ZECF) documents
B. Mathematics and Science syllabi
C. School-based assessment guidelines
D. Lesson plans and schemes of work
E. Continuous Professional Development (CPD) records
F. School timetables and departmental meeting minutes

Document review enabled verification of reported practices and enhanced triangulation of data.

**Interview Recording and Field Notes**

With participants' consent, interviews were audio-recorded and supplemented with field notes to ensure accuracy and completeness of qualitative data.

**Data Collection Procedures**

Permission to conduct the study was obtained from the District Education Board Secretary (DEBS) and school headteachers. Questionnaires were distributed electronically to teachers, while interviews with HODs, headteachers, and SESOs were conducted face-to-face or via telephone, depending on participant availability.

**Data Analysis**

Quantitative data from questionnaires were analysed using descriptive statistics, including frequencies, percentages, and mean scores, with the aid of Microsoft Excel and SPSS. Qualitative data from interviews and

document reviews were analysed using thematic analysis, where responses were coded and grouped into themes aligned with the study objectives.

### Ethical Considerations

Ethical principles of voluntary participation, confidentiality, anonymity, and informed consent were strictly observed. Participants were informed of the purpose of the study and their right to withdraw at any time without penalty. No personal identifiers or school names were used in reporting the findings.

### Summary

This chapter described the research design, population, sample size, sampling procedures, data collection instruments, data collection procedures, data analysis methods, and ethical considerations guiding the study. The next chapter presents the results of the study.

## RESULTS AND FINDINGS

### Teachers' awareness and understanding of CBC

The analysis of teacher questionnaire responses (n = 20) indicates that the implementation of the Competency-Based Curriculum (CBC) in Mathematics and Science subjects in Kabwe District is characterised by moderate levels of teacher preparedness, partial pedagogical alignment with CBC principles, and substantial systemic constraints that undermine effective practice. While a majority of teachers reported having received some form of formal CBC training (70%), the depth of this training appears insufficient to ensure consistent understanding and confident enactment of the curriculum. Teachers' self-reported understanding of CBC goals, expected learner competencies, and interpretation of the CBC syllabus remained moderate, with mean scores clustered around the mid-point of the Likert scale. This suggests that although teachers are not completely unfamiliar with CBC principles, their grasp of the curriculum is not yet strong enough to support full and confident implementation across diverse classroom contexts.

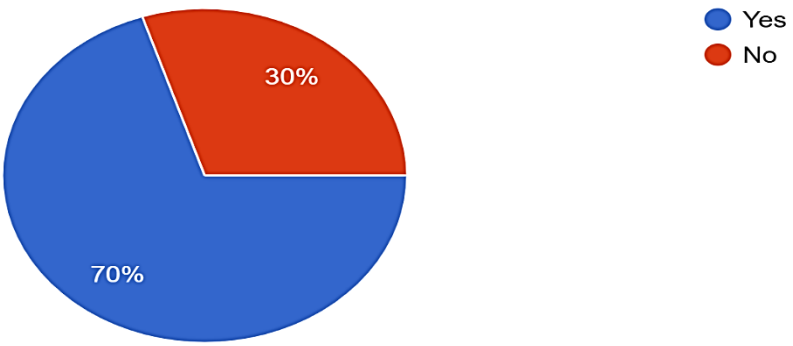


Figure 4.1 – Teachers received formal CBC training

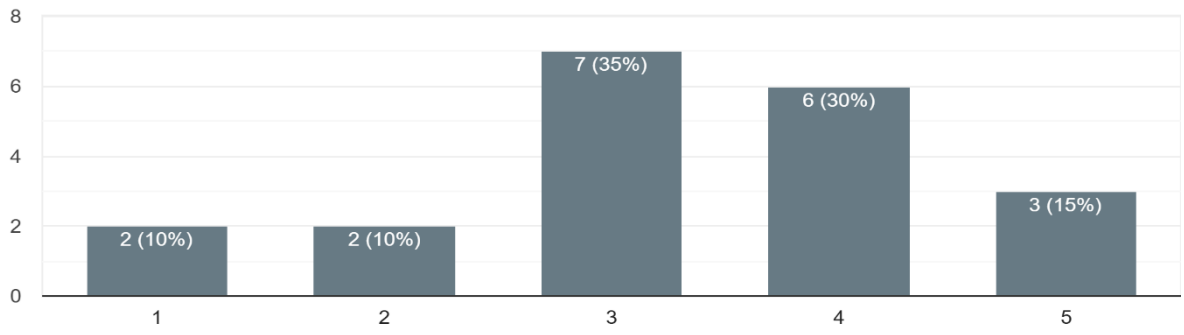


Figure 4.2 – Teachers' self-reported understanding of CBC goals

### Teaching and learning practices

In terms of pedagogy, the findings suggest a gradual but uneven shift towards learner-centred instructional practices, which are central to the CBC philosophy. Many teachers indicated that they frequently employ learner-centred strategies such as group work, problem-solving activities, and real-life applications of mathematical and scientific concepts. These practices were associated with moderate to high mean scores, indicating a willingness among teachers to adapt their classroom methods in line with CBC expectations. However, the perceived impact of these pedagogical changes on learner engagement and learning outcomes was less convincing. Fewer teachers strongly agreed that CBC has led to noticeable improvements in learner engagement, pointing to a possible disconnect between instructional intentions and actual classroom realities. This gap may reflect contextual constraints such as large class sizes, limited time, and insufficient instructional materials, which restrict the effective use of interactive and differentiated teaching approaches.

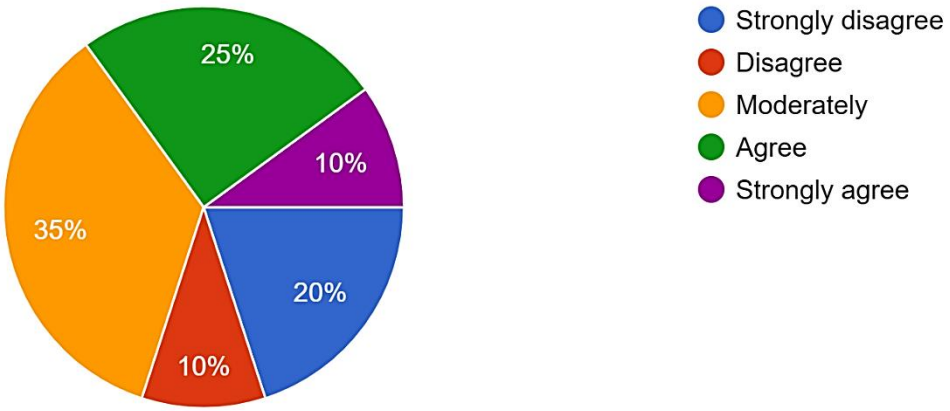


Figure 4.3 – Teachers' responses to learners' engagement in CBC

**Assessment practices under CBC**

Assessment emerged as one of the most problematic dimensions of CBC implementation. Although many teachers expressed conceptual agreement that competency-based assessment better reflects learners' abilities than traditional examination-oriented approaches, they reported significant difficulties in applying these assessment methods in practice. Teachers indicated limited clarity regarding assessment guidelines and expressed low confidence in managing continuous assessment demands alongside existing teaching responsibilities. In particular, the manageability of continuous assessment within current workloads was rated poorly, with a substantial proportion of teachers explicitly disagreeing that such assessment is feasible under prevailing conditions. This finding highlights a critical implementation gap between CBC assessment policy and classroom-level realities, where expectations for ongoing, formative assessment are not adequately supported by time allocation, staffing levels, or simplified assessment tools.

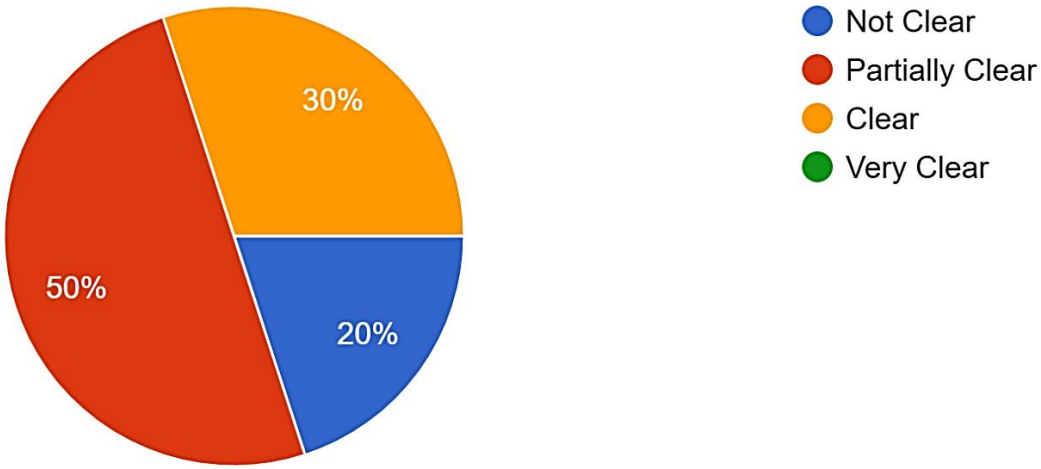


Figure 4.4 – Teachers' responses to assessment under CBC

**Resources and support**

The most pronounced implementation challenges were associated with teaching and learning resources. The data reveal severe shortages of essential materials, including textbooks, mathematical instruments, and other instructional resources required for effective CBC delivery. Nearly all teachers reported that learners lack access to the prescribed CBC textbooks and learning materials, and a large majority indicated that basic instructional tools are either insufficient or unavailable. These shortages directly undermine the practical, activity-based orientation of CBC, particularly in Mathematics and Science subjects where hands-on activities, experiments, and guided practice are essential for competency development. In addition to material constraints, institutional and supervisory support was perceived as weak or inconsistent. Teachers reported limited ongoing support from school management and Subject Education Standards Officers (SESOs), suggesting that monitoring and professional guidance mechanisms are not yet functioning effectively to support curriculum reform at school level.

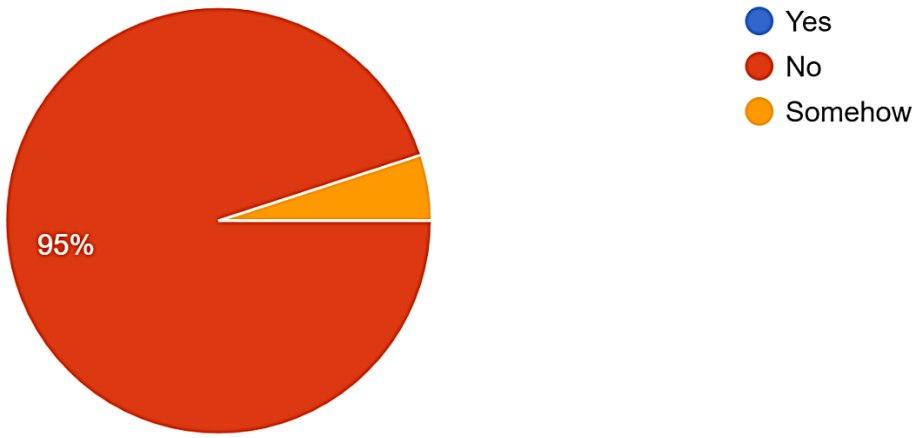


Figure 4.5 – Teachers' responses to availability of teaching and learning resources

Professional development needs were strongly emphasised by teachers. Although some respondents acknowledged that in-service training had positively contributed to their understanding of CBC, there was unanimous agreement on the need for further subject-specific professional development, particularly in Mathematics and Science. Teachers expressed a clear preference for practical, classroom-oriented training that focuses on lesson planning, assessment design, and the adaptation of CBC principles to large and resource-constrained classrooms. This consensus indicates that existing training initiatives may be too general or theoretical, failing to address the specific pedagogical and assessment challenges faced by subject teachers.

Overall, the findings demonstrate that the main obstacles to effective CBC implementation in Kabwe District are not rooted in teacher resistance or negative attitudes towards the reform, but rather in inadequate enabling conditions. Teachers generally recognise the potential of CBC to improve learner skills, critical thinking, and real-world application of knowledge. However, the absence of adequate resources, the burden of continuous assessment, large class sizes, and limited sustained professional and supervisory support significantly constrain their ability to translate CBC policy into effective classroom practice. These results suggest that without targeted investment in materials, structured subject-specific professional development, and stronger institutional support systems, the intended benefits of the Competency-Based Curriculum are unlikely to be fully realised in Mathematics and Science classrooms.

**Analysis of Heads of Department (HODs) Responses on CBC Implementation**

The analysis of responses from Heads of Department (HODs) reveals a consistent and deeply contextualised picture of how the Competency-Based Curriculum (CBC) is being implemented in Mathematics and Science departments across secondary schools in Kabwe District. While a few HODs described pockets of progress and collaboration within departments, the dominant narrative is one of constrained implementation characterised by inadequate resources, limited teacher preparedness, unclear assessment guidance, high learner enrolments,

and weak systemic alignment between policy formulation and classroom realities. Here are the key responses received from the HODs;

**Inadequate teacher preparedness for effective CBC implementation**

Across the HOD interviews, teacher preparedness was repeatedly described as insufficient, particularly in relation to lesson planning, interpretation of CBC modules, and competence assessment. While teachers were reported to be writing lesson plans and attempting learner-centred approaches, many lacked confidence and clarity on what correct CBC implementation entails. One HOD explained that "***lesson plans are being written, but we really need a guide… there's little training that has been done, hence a lot of misinterpretation***". Another stated plainly that teachers are "***not adequately prepared in terms of planning***," noting that implementation is largely experimental rather than systematic.

These findings suggest that teacher preparedness under CBC is largely procedural rather than conceptual. Teachers may comply with formal requirements such as lesson planning, but without strong curriculum literacy and assessment competence, implementation remains superficial. This reflects a significant implementation gap where teachers are expected to enact a complex pedagogical reform without sufficient professional grounding.

**CBC training is limited, general, and insufficiently sustained**

Most HODs acknowledged that CBC training had taken place, mainly during the initial rollout, but they consistently described it as inadequate. Training was said to focus mainly on lesson plan formats and general orientation rather than subject-specific pedagogy or assessment. One HOD noted, "***the only training that was there is just about teaching teachers about the lesson plan***" and emphasised that this did not translate into real classroom confidence. In some departments, only one teacher had attended CDC training and was expected to guide others, despite "***not having the information fully***".

The limited scope and cascade nature of CBC training have resulted in uneven teacher competence across departments. Without continuous, subject-focused professional development, teachers struggle to internalise CBC principles, leading to inconsistent and fragmented implementation. This highlights the need for sustained, practical CPDs tailored specifically to Mathematics and Science.

**Severe shortage of teaching and learning resources**

Resource inadequacy was the most dominant theme across all HOD responses. Many departments reported having no CBC-aligned textbooks, no hard-copy modules, and insufficient teaching aids. One HOD stated emphatically, "***we have no material, no apparatus… we have no books that we have been given to teach CBC effectively***". Others explained that teachers rely on soft copies of modules, which are difficult to access and print, forcing them to use old curriculum textbooks and improvised materials.

The lack of basic instructional resources severely undermines the practical and inquiry-based orientation of CBC. In Mathematics and Science, where hands-on activities are essential for competence development, resource shortages compel teachers to revert to theoretical, teacher-centred methods, thereby widening the gap between CBC policy intentions and classroom practice.

**Large class sizes and high enrolment hinder learner-centred pedagogy**

HODs consistently reported that overcrowded classrooms—often with 40 to over 80 learners—make effective CBC implementation extremely difficult. One HOD noted, "***on average, there are about 70 pupils in a class… it's too big for a teacher to manage***" and that monitoring learner activities becomes impossible within limited lesson time. Several respondents linked increased enrolment to the free education policy, which has intensified these challenges.

CBC assumes manageable class sizes that allow individualised support, continuous feedback, and close monitoring of learner progress. The reality of overcrowded classrooms renders these assumptions unrealistic,

forcing teachers to compromise learner-centred approaches. As a result, CBC implementation becomes symbolic rather than transformative.

**Heavy teacher workload and staffing shortages**

Many HODs reported that shortages of Mathematics and Science teachers have led to excessive workloads, with some teachers handling up to 36–40 periods per week. One HOD explained that such workloads leave teachers "***tired and worn out***," making it difficult to prepare hands-on lessons or provide individual learner support. Another emphasised that "***splitting classes into smaller groups does not take place because we have very few teachers***."

High workload and staffing shortages directly undermine the quality of CBC implementation. Activity-based teaching, continuous assessment, and reflective planning require time and energy, both of which are constrained when teachers are overloaded. Without adequate staffing, CBC expectations remain unattainable in practice.

**Unclear and inconsistent competency-based assessment practices**

Assessment emerged as one of the most problematic areas of CBC implementation. HODs reported a lack of clear guidelines, rubrics, and specimen papers, particularly in Mathematics and Science. One HOD observed, "***we expected to receive specimen papers… for biology there's nothing, for physics there's nothing***". As a result, teachers rely on tests, tasks, and projects through "***trial and error***," unsure whether their methods align with national expectations.

The absence of standardised assessment guidance has led to inconsistent and uncertain assessment practices across schools. This undermines the credibility of school-based assessment and weakens teachers' confidence in evaluating learner competencies, posing a serious threat to the integrity of CBC implementation

**Policy–practice disconnect and limited teacher involvement**

Several HODs highlighted a disconnect between CBC policy design and classroom realities, arguing that teachers were not adequately involved in curriculum development. One respondent remarked that policymakers "***don't really know what is going on the ground***," especially regarding resource availability and infrastructure. Another noted that CBC assumes equal access to ICT and laboratories, yet ***"some schools don't even have a single computer***."

This disconnect reflects a top-down approach to curriculum reform that overlooks contextual realities. Without meaningful teacher involvement and feedback, CBC policies risk being aspirational rather than implementable, thereby perpetuating implementation gaps at school level.

**Departmental collaboration exists but cannot compensate for systemic gaps**

Many HODs described internal efforts such as team planning, peer support, lesson study, and departmental CPDs. One HOD explained that teachers "***plan together and support one another***," while another noted that departments try to improvise teaching aids using local materials. However, these efforts were repeatedly described as insufficient in the absence of resources and clear guidance.

While departmental collaboration provides some resilience, it cannot substitute for systemic support. CBC implementation requires coordinated action at national, district, and school levels. Without this alignment, departmental initiatives remain isolated and limited in impact.

**Thematic Analysis of Headteachers' Responses on CBC Implementation**

**School-level commitment to CBC implementation**

Headteachers generally acknowledged that the CBC represents a major curricular shift and reported deliberate efforts to manage its implementation carefully at school level. Several schools adopted a selective approach,

assigning CBC Mathematics and Science classes to teachers perceived as more competent or previously trained. One headteacher explained that "***we have picked the competent teachers, mostly without leaving out the HODs, to be the ones to pilot this particular program,***" emphasising the importance of establishing a strong foundation at Form 1 level. Others reported introducing CPDs and encouraging departmental collaboration as a way of supporting teachers during the transition.

These responses suggest that school leadership recognises the risks associated with poorly managed curriculum reform and has attempted to mitigate them through selective staffing and internal support structures. However, this approach also highlights underlying capacity constraints, where effective CBC implementation is dependent on a small number of trained or confident teachers rather than broad-based institutional readiness.

**CBC implementation perceived as rushed and underprepared**

A recurring concern among headteachers was that CBC implementation was introduced too quickly, without adequate preparation in terms of resources, training, and funding. One respondent noted that "***the main implementation challenge we've observed is that it was rushed… the books should have been in place first, and teachers should have been properly oriented***". Several headteachers indicated that schools are relying on unverified materials shared through informal platforms such as WhatsApp, describing the implementation process as largely experimental.

This perception of rushed implementation reinforces the existence of a policy–practice gap at the system level. Introducing a resource-intensive curriculum without sufficient preparatory groundwork undermines school confidence and forces leaders and teachers into improvisational practices that weaken fidelity to CBC principles.

**Staffing shortages and teacher workload as major implementation constraints**

All headteachers highlighted shortages of Mathematics and Science teachers as a significant barrier to effective CBC implementation. One headteacher stated plainly that "***no school really has enough teachers***" in these subjects and that teacher overload compromises lesson quality and preparation time. Another explained that when teachers are "***in a classroom from the first period to the last***," they have little opportunity to reflect, plan, or prepare activity-based lessons.

CBC requires extensive preparation, learner monitoring, and assessment follow-up, all of which demand manageable workloads. The evidence indicates that existing staffing levels are incompatible with these demands, resulting in compromised lesson quality and reduced depth of learner engagement.

**Timetabling flexibility exists, but does not fully resolve CBC demands**

Some headteachers reported that timetabling structures are, in principle, flexible enough to support practical and inquiry-based learning. Strategies such as using afternoon periods, extending lessons into preparation time, or allowing teachers to work beyond the formal timetable were described. One headteacher noted that "***teachers are free to go outside the timetable… it takes sacrifice, dedication, because it's a new thing***".

While leadership efforts to introduce timetable flexibility demonstrate commitment, reliance on teacher sacrifice is not sustainable. Effective CBC implementation requires systemic time allocation rather than voluntary extensions that risk teacher fatigue and burnout.

**Resource provision remains inadequate despite leadership efforts**

Although some schools reported procuring projectors, internet connectivity, and printed modules, headteachers consistently acknowledged that these efforts fall short of CBC requirements. One headteacher explained that "***this one requires a lot of new materials, and those materials aren't even available yet***". Another highlighted that CBC classrooms often rely on basic materials such as "***manila paper and markers***," which do not support hands-on experimentation and inquiry learning.

These findings indicate that while school leadership may attempt to mobilise resources locally, CBC implementation cannot be sustained through piecemeal procurement. The curriculum's practical orientation requires substantial, consistent investment beyond the capacity of individual schools.

**CPDs and departmental structures are functional but uneven in impact**

Headteachers generally reported that departmental meetings, CPDs, and HOD-led initiatives are functioning and form a key part of CBC implementation. Some emphasised that facilitation is not restricted to HODs, noting that "***you don't just depend on the HOD… you look at who was trained in that particular area***". Regular CPDs were described as platforms for collaboration, lesson reflection, and shared problem-solving.

These structures provide an important foundation for school-based professional learning. However, their effectiveness is constrained by the limited expertise available and the absence of clear national guidance, resulting in CPDs that focus more on coping strategies than on deep pedagogical transformation.

**Assessment guidance under CBC remains unclear and inconsistent**

Headteachers expressed concern about the lack of clear guidelines on competency-based assessment, including formats for continuous assessment and record-keeping. One headteacher observed that "***the CDC hasn't yet provided clear guidelines on the format or the types of assessments… it feels like the CDC is still catching up***". As a result, schools are using improvised assessment approaches with limited confidence in their alignment to national expectations.

The absence of standardised assessment guidance creates uncertainty at school level and threatens consistency across institutions. This undermines both accountability and the credibility of school-based assessment, which is central to the CBC framework.

**Dependence on external support from SESOs and DEBS**

Several headteachers acknowledged the role of SESOs and DEBS in supporting CBC implementation through monitoring visits, meetings, and professional dialogue. One respondent noted that "***we do receive substantial support from both the SESOs and the DEBS***," particularly in terms of verification of materials and guidance during monitoring visits.

External support structures play an important bridging role between policy and practice. However, their effectiveness depends on the extent to which SESOs themselves are adequately trained and resourced to support CBC implementation consistently across schools.

**Leadership recommendations emphasise preparation, resources, and coherence**

Headteachers strongly recommended early curriculum preparation, improved resourcing, and coherent guidance from the CDC. One suggested that curriculum review processes should begin "***at least three years before the change***," while another stressed the urgent need for teacher guides, learner textbooks, and unified lesson plan formats.

These recommendations reflect leadership-level recognition that successful curriculum reform requires long-term planning, adequate funding, and clear instructional coherence. Without these conditions, schools remain reactive rather than strategic in their implementation efforts.

Overall, headteachers support the goals and philosophy of the CBC but view its implementation as constrained by systemic weaknesses rather than school-level resistance. Their accounts emphasise that leadership commitment alone cannot compensate for shortages in staffing, resources, assessment guidance, and preparatory planning. These findings align closely with teacher and HOD perspectives, reinforcing the conclusion that CBC implementation challenges in Kabwe District are structural and systemic in nature rather than attitudinal.

**Thematic Analysis of Subject Education Standards Officers (SESO) Responses**

**CBC is formally implemented, but pedagogical practice remains largely teacher-centred**

SESOs consistently reported that although CBC has been rolled out across schools, classroom practice in Mathematics and Science remains heavily influenced by the 2013 curriculum. One SESO observed that "***the pedagogy being employed by our teachers is still stuck in the 2013 curriculum,***" explaining that teachers tend to dominate lessons instead of facilitating learner activity. Another noted that teachers "***want to do everything for the learners***," despite CBC requiring learners to take an active role in constructing knowledge.

These findings indicate that the main challenge at classroom level is not curriculum rejection, but pedagogical inertia. Teachers struggle to shift from content transmission to facilitation of learner inquiry, suggesting that CBC implementation has not yet achieved the intended transformation in teaching practice.

**Insufficient teacher capacity in curriculum interpretation, pedagogy, and assessment**

SESOs highlighted widespread teacher capacity gaps, particularly in interpreting CBC documents, designing learner activities, and assessing competencies. One respondent stated that teachers "***still need a lot of support and training***," especially in preparing activities that allow learners to extract. Another SESO noted that many teachers find CBC lesson formats "too time-consuming" and revert to old methods during implementation.

These capacity gaps suggest that CBC demands skills that many teachers were not trained for during pre-service education. Without deliberate retraining and sustained professional support, teachers remain ill-equipped to translate curriculum intentions into effective classroom practice.

**Training provided is inadequate relative to the complexity of CBC**

SESOs acknowledged that some training had been conducted but emphasised that it was insufficient in duration and depth. One respondent remarked that "***you can't just have a 30-minute or one-hour***". Another stressed the need to empower institutions such as the National Science Centre to provide hands-on, subject-specific training, particularly for science teachers.

The mismatch between the complexity of CBC and the limited scope of training undermines teacher confidence and competence. This reinforces the need for sustained, practice-oriented CPDs rather than short, one-off orientation sessions.

**Resource constraints acknowledged, but SESOs emphasise teacher resourcefulness**

SESOs recognised that lack of materials—especially printed modules, reference books, and laboratory resources—remains a major challenge. However, some respondents placed strong emphasis on teacher initiative. One SESO argued that "***the onus is really on the teachers to become resourceful***," noting that "***90 to 95 percent of a CBC lesson is prepared before the lesson***". At the same time, SESOs acknowledged that rural schools face compounded challenges due to poor network connectivity and limited access to reference materials.

This theme reveals a tension between systemic responsibility and individual teacher effort. While teacher creativity and preparation are essential under CBC, excessive reliance on individual resourcefulness risks normalising structural deficiencies in resourcing and infrastructure, particularly in under-resourced schools.

**Class size and teacher workload severely undermine CBC implementation**

All SESOs strongly emphasised the negative impact of large class sizes and heavy teacher workloads. One respondent noted that CBC requires "***individualised attention to the learners***," which becomes impossible when teachers handle "***five classes of 100 plus learners***". Another explained that science teachers often carry "***a minimum of 30 periods a week***," leaving little time for lesson preparation and learner follow-up.

CBC assumptions about personalised learning are incompatible with existing staffing realities. Without deliberate recruitment and redistribution of Mathematics and Science teachers, the learner-centred ambitions of CBC cannot be realised at scale.

**Inequities between urban and rural schools affect CBC delivery**

SESOs highlighted disparities in CBC implementation between urban and rural schools, particularly in access to internet resources, reference books, and laboratory equipment. One respondent asked rhetorically, "***do you expect the content to be the same?***" when comparing teachers in urban schools to those in remote areas. These inequities were linked to uneven learner exposure and inconsistent curriculum delivery.

CBC implementation is currently shaped by contextual inequities, resulting in uneven learning opportunities. Without targeted support for rural and high-need schools, CBC risks widening educational inequalities rather than reducing them.

**Lack of clear assessment roadmap and alignment with national examinations**

Assessment was identified as a critical unresolved issue. SESOs stressed the need for CDC to work closely with the Examinations Council of Zambia to clarify how competencies will be assessed. One respondent described the situation as "a tricky one," noting the tension between CBC's learner-paced philosophy and the demands of standardised national examinations. Teachers are expected to complete syllabi while also adhering to CBC principles, creating confusion and pressure.

The absence of a clear, shared assessment framework undermines teacher confidence and threatens coherence between curriculum, teaching, and examination practices. Without alignment between CBC and national assessment systems, implementation will remain fragmented.

**Teacher training institutions are not yet aligned with CBC requirements**

SESOs argued that CBC implementation challenges stem partly from pre-service teacher education. One respondent stated that "***the best thing would have been to include the CBC requirements in our teacher training programs***" so that new teachers enter the system already prepared. Current teachers, they argued, require retraining to bridge this gap.

CBC implementation is constrained by systemic misalignment between curriculum reform and teacher education. Without reforming pre-service training, the education system will continue producing teachers unprepared for CBC demands.

**Policy-level recommendations emphasise staffing, monitoring, and sustained CPD**

SESOs strongly recommended deliberate recruitment of Mathematics and Science teachers, improved monitoring of schools, and sustained CPDs. One respondent argued that recruitment policies favour social sciences while leaving STEM areas understaffed, calling this "***a critical point***" affecting CBC success. They also emphasised the role of administrators in supporting, monitoring, and mentoring teachers rather than leaving them to struggle alone.

From the SESO perspective, effective CBC implementation requires coordinated policy action rather than isolated school-level effort. Staffing, monitoring, and professional development must be treated as systemic priorities to close the implementation gap.

Overall, SESOs perceive CBC as a sound curriculum whose implementation is constrained by limited teacher capacity, inadequate training, heavy workloads, resource shortages, and misalignment with assessment systems. While they emphasise teacher responsibility and professionalism, their accounts also acknowledge deep structural constraints that require policy-level intervention. These findings align closely with those from teachers, HODs, and headteachers, reinforcing the conclusion that CBC implementation challenges in Kabwe District are systemic rather than attitudinal.

## SUMMARY OF KEY FINDINGS

The triangulated analysis of data from teachers, Heads of Department (HODs), headteachers, and Subject Education Standards Officers (SESOs) reveals a high level of convergence regarding the nature, causes, and consequences of implementation gaps in the Competency-Based Curriculum (CBC) for Mathematics and Science in Kabwe District. Across all respondent groups, there is broad agreement that while CBC is formally in place and generally supported in principle, its classroom enactment is constrained by systemic, institutional, and capacity-related challenges rather than by outright resistance to curriculum reform.

Across all levels, teacher preparedness emerged as a central concern. Teachers reported moderate understanding of CBC goals and pedagogy, but low confidence in assessment and workload management. HODs reinforced this view, describing preparedness as uneven and often limited to compliance with lesson-planning formats rather than deep curriculum understanding. Headteachers acknowledged these gaps, noting that only a small number of trained or ***"competent"*** teachers are often relied upon to pilot CBC implementation. SESOs further confirmed that many teachers remain anchored in teacher-centred practices associated with the 2013 curriculum, struggling to interpret CBC requirements and design learner-driven activities. Collectively, the evidence indicates that teacher preparedness is partial and fragile, sustained largely by individual effort and departmental improvisation rather than by systematic professional capacity building.

A second, strongly corroborated finding relates to the inadequacy of CBC training and professional development. Teachers, HODs, and headteachers consistently described CBC training as insufficient in scope, duration, and subject specificity, often limited to initial orientation or lesson-plan templates. SESOs supported this view, emphasising that short CPD sessions cannot adequately prepare teachers for the conceptual and pedagogical demands of CBC. While school-based CPDs and peer collaboration were reported across schools, all respondent groups agreed that these initiatives cannot substitute for sustained, structured, subject-focused training led by adequately capacitated institutions. The consensus across stakeholders is that the current training model has not kept pace with the complexity of CBC implementation, particularly in Mathematics and Science.

Teaching and learning resources constituted the most severe and universally cited implementation constraint. Teachers overwhelmingly reported lack of textbooks, learning materials, mathematical instruments, laboratory equipment, and ICT resources. HODs provided detailed accounts of departments operating with only soft copies of modules, single copies of materials, or complete reliance on old curriculum textbooks. Headteachers acknowledged these shortages, noting that CBC requires resources that schools cannot procure under existing funding models, even where leadership attempts to improvise through projectors, internet access, or locally produced materials. SESOs confirmed these challenges district-wide, while also highlighting stark disparities between urban and rural schools. The triangulated evidence clearly indicates that CBC's practical and inquiry-based orientation is fundamentally undermined by chronic resource shortages.

Large class sizes, teacher shortages, and heavy workloads were consistently identified as major structural barriers. Teachers reported difficulty managing continuous assessment and learner-centred activities in overcrowded classrooms. HODs and headteachers explained that high enrolment—often exceeding 60–80 learners per class—makes individualised learning and monitoring practically impossible. SESOs reinforced this finding, citing critical shortages of Mathematics and Science teachers, with some handling up to 40 teaching periods per week. Across all respondent groups, there was agreement that CBC's assumptions of personalised learning, continuous feedback, and differentiated instruction are incompatible with current staffing and enrolment realities.

Another area of strong convergence concerned competency-based assessment, which all groups identified as unclear, inconsistent, and poorly supported. Teachers expressed difficulty managing continuous assessment and uncertainty about assessment standards. HODs highlighted the absence of assessment exemplars, rubrics, and specimen papers, leading to trial-and-error practices. Headteachers echoed these concerns, noting a lack of guidance on assessment formats and record-keeping. SESOs contextualised this challenge within a broader policy tension between CBC's learner-paced philosophy and Zambia's standardised examination system. Collectively, the evidence shows that weak assessment guidance constitutes a critical implementation gap that threatens the credibility and coherence of CBC.

Despite these challenges, the study found strong evidence of commitment and agency at school and departmental levels. Teachers demonstrated willingness to adopt learner-centred methods where possible. HODs described active peer support, team planning, lesson study, and departmental CPDs. Headteachers reported leadership efforts to protect time for CPDs, pilot CBC with trained staff, and mobilise limited resources. SESOs acknowledged "pockets of good practice" where teachers have taken personal initiative to research and adapt CBC approaches. However, all groups emphasised that such efforts are constrained and unsustainable without systemic support.

A recurring, cross-cutting finding concerns the policy–practice disconnect. Teachers and HODs expressed frustration that CBC assumes availability of resources, infrastructure, and preparation that do not exist in most schools. Headteachers described CBC implementation as rushed, with inadequate preparatory planning and funding. SESOs acknowledged that teachers were not sufficiently involved in curriculum design and that pre-service teacher education remains misaligned with CBC requirements. This disconnect results in schools improvising implementation under conditions for which the curriculum was not designed.

In synthesis, the triangulated findings demonstrate that the implementation gap in CBC Mathematics and Science in Kabwe District is systemic rather than attitudinal. Stakeholders across all levels support the goals of CBC and recognise its potential to enhance learner skills, critical thinking, and real-world application. However, inadequate training, severe resource shortages, excessive workloads, large class sizes, unclear assessment frameworks, and weak system alignment collectively constrain effective implementation. Without coordinated policy-level intervention to address these structural issues, CBC implementation is likely to remain partial, uneven, and dependent on individual effort rather than institutional capacity.

## DISCUSSION OF FINDINGS AND RECOMMENDATIONS

### Overview

This chapter discusses the key findings of the study on the implementation of the Competency-Based Curriculum (CBC) in Mathematics and Science in Kabwe District. The discussion is guided by Fullan's theory of educational change and Rogan and Grayson's curriculum implementation framework, which together provide a lens for understanding why curriculum reforms succeed or struggle in real school contexts. The chapter further presents conclusions and policy-oriented recommendations aimed at strengthening CBC implementation at national, district, and school levels.

While the study initially presents descriptive statistics to establish a baseline profile of CBC implementation, further analysis suggests that implementation outcomes are not randomly distributed. Patterns across the data indicate that teacher confidence, pedagogical adaptation, and assessment practices are systematically associated with training exposure, workload, class size, and resource availability rather than with teacher attitudes. This suggests that implementation challenges are structurally produced and capacity-bound, reinforcing the argument that CBC implementation difficulties stem from systemic constraints rather than resistance or lack of professional commitment.

### Discussion of Findings Using Fullan's Theory of Educational Change

Fullan's theory of educational change emphasises that successful curriculum reform depends on the interaction of capacity building, clarity of reform goals, availability of resources, leadership support, and sustained professional learning, rather than mere policy adoption. The findings of this study strongly align with this theoretical perspective.

### Teacher capacity and professional learning

According to Fullan, meaningful change requires teachers to develop new knowledge, skills, and beliefs over time. The findings revealed that teachers in Kabwe District possess only moderate understanding of CBC principles and limited confidence in competency-based assessment. This suggests that capacity building under CBC has been insufficient and uneven. While some training was provided during the rollout phase, it lacked depth, continuity, and subject specificity, particularly in Mathematics and Science. As Fullan argues, one-off

training sessions rarely lead to sustained pedagogical change. Instead, teachers require continuous, practice-oriented professional learning opportunities that allow them to experiment, reflect, and refine their instructional approaches.

**Change overload and reform fatigue**

Fullan also warns that reforms introduced without adequate preparation often led to superficial compliance rather than deep change. The perception among teachers, HODs, and headteachers that CBC implementation was rushed supports this assertion. Teachers were expected to adopt learner-centred pedagogy, continuous assessment, and new planning formats without sufficient time, training, or materials. This has resulted in reform fatigue, where teachers revert to familiar teacher-centred practices associated with the previous curriculum, despite their awareness of CBC expectations.

**Leadership and systemic support**

Fullan highlights the role of leadership in creating conditions for reform. The findings show that while school leadership and departmental structures are generally supportive, their efforts are constrained by systemic limitations such as inadequate funding, staffing shortages, and unclear national guidance. Leadership commitment alone has not been sufficient to overcome these barriers, confirming Fullan's assertion that school-level change must be supported by coherent system-level policies and resources.

**Discussion of Findings Using Rogan and Grayson's Curriculum Implementation Framework**

Rogan and Grayson's framework conceptualise curriculum implementation in terms of levels of implementation, capacity to support implementation, and external support and pressure. The findings of this study correspond closely with these dimensions.

**Level of curriculum implementation**

The framework suggests that implementation progresses from basic compliance to more advanced, learner-centred practices. Evidence from teachers, HODs, headteachers, and SESOs indicates that CBC implementation in Kabwe District largely remains at lower levels, characterised by partial adoption of learner-centred strategies and continued reliance on traditional teaching methods. While some elements of CBC are visible—such as group work and project tasks—these are not consistently or deeply embedded due to contextual constraints.

**Capacity to support implementation**

Rogan and Grayson emphasise that effective implementation requires adequate teacher knowledge, manageable class sizes, sufficient resources, and supportive school structures. The findings clearly show that this capacity is weak in many schools. Large class sizes, heavy teacher workloads, shortages of Mathematics and Science teachers, and severe lack of teaching and learning materials significantly undermine CBC implementation. In this regard, the study confirms that the implementation gap is not due to resistance, but rather to insufficient capacity at school level.

**External support and pressure**

The framework recognises the importance of external agencies such as curriculum developers, district offices, and inspection bodies. While SESOs and DEBS offices provide some monitoring and support, the findings indicate that this support is inconsistent and sometimes limited by the capacity of the officers themselves. Additionally, weak alignment between CBC principles and national assessment systems exerts contradictory pressure on teachers, who must balance learner-paced instruction with the demands of standardised examinations.

**Synthesis of Theoretical Insights**

Taken together, Fullan's theory and Rogan and Grayson's framework explain why CBC implementation in Kabwe District remains partial and uneven. The reform has been introduced in a context where teacher

capacity, resources, assessment clarity, and systemic coherence are insufficient to support deep pedagogical change. As both theories predict, curriculum change under such conditions results in surface-level compliance rather than transformation of classroom practice.

While Fullan's theory and Rogan and Grayson's framework explain key dimensions of curriculum change, the findings suggest that both understate the role of chronic under-resourcing, examination pressure, and teacher deployment policies in shaping implementation outcomes. In the Zambian context, what may appear as resistance or slow adoption often reflects pragmatic adaptation to systemic constraints rather than ideological opposition to reform. This indicates the need to complement existing change theories with political-economic and context-sensitive perspectives when analysing curriculum reform in low-resource systems.

Despite systemic constraints, the study identified pockets of effective practice at school and departmental levels. These included collaborative lesson planning, peer mentoring, improvisation of locally available materials, and leadership-supported CPDs. Such practices demonstrate teacher resilience and adaptive agency, suggesting that CBC implementation is not uniformly weak but uneven. However, these innovations remain isolated and dependent on individual effort, underscoring the need for institutional mechanisms to identify, support, and scale effective local practices.

# CONCLUSIONS

The study concludes that the implementation of the Competency-Based Curriculum in Mathematics and Science in Kabwe District is constrained by systemic and structural factors rather than negative teacher attitudes. Teachers, HODs, headteachers, and SESOs generally support the philosophy and intentions of CBC, recognising its potential to promote critical thinking, practical skills, and learner autonomy. However, inadequate training, severe resource shortages, large class sizes, heavy workloads, unclear assessment frameworks, and weak alignment between curriculum and examinations significantly limit effective implementation. Without targeted and coordinated interventions at policy and institutional levels, CBC is unlikely to achieve its intended outcomes.

Although the quantitative analysis relies primarily on descriptive statistics, this was intentional given the exploratory nature of the study and the need to establish a diagnostic baseline. Future studies could build on this work through correlation and regression analyses to examine relationships between variables such as training exposure and teacher confidence, or class size and pedagogical practice.

This study represents a cross-sectional snapshot of CBC implementation; longitudinal research is recommended to examine how practices evolve, stabilise, or regress over time as system-level conditions change. Variations observed across schools suggest that location, leadership practices, and access to resources mediate CBC implementation outcomes, warranting more systematic comparative analysis in future studies.

**Policy-Ready Recommendations**

**Recommendations to the Curriculum Development Centre (CDC)**

A. Develop and distribute subject-specific teacher guides for Mathematics and Science, including lesson exemplars, suggested learner activities, and pacing guidelines.
B. Provide clear competency-based assessment frameworks, including rubrics, specimen tasks, and exemplars aligned with national assessment expectations.
C. Ensure availability of hard-copy syllabi and modules for all schools, particularly those with limited access to printing and digital infrastructure.
D. Strengthen collaboration with the Examinations Council of Zambia to align CBC pedagogy with assessment and examination practices.
E. Involve practicing teachers and subject specialists more actively in curriculum review and material development processes.

**Recommendations to DEBS and the Ministry of Education**

A. Implement a deliberate recruitment and deployment strategy to address shortages of Mathematics and Science teachers and reduce teacher workload.

B. Increase and ring-fence funding specifically for CBC implementation, recognising the higher resource demands of activity-based learning.
C. Strengthen monitoring and support systems, ensuring SESOs are adequately trained and resourced to provide instructional guidance, not just compliance checks.
D. Integrate CBC principles into pre-service teacher education programmes to ensure new teachers enter the system prepared for competency-based teaching.

**Recommendations to Subject Education Standards Officers (SESOs)**

A. Provide regular, subject-focused in-service training and school-based coaching for Mathematics and Science teachers.
B. Support schools with model CBC lessons, assessment moderation, and reflective feedback based on classroom observations.
C. Facilitate inter-school professional learning communities to share best practices and reduce isolation among teachers.
D. Advocate for context-sensitive implementation approaches, particularly for rural and high-enrolment schools.

**Recommendations to Schools and School Management**

A. Strengthen departmental collaboration through structured CPDs, lesson study, and peer mentoring focused on CBC pedagogy and assessment.
B. Prioritise resource mobilisation and budgeting for CBC-related teaching and learning materials, including low-cost locally produced teaching aids.
C. Manage timetables strategically to allow time for practical work, assessment, and teacher preparation, while avoiding reliance on unsustainable teacher sacrifice.
D. Encourage a supportive instructional culture where teachers are monitored, mentored, and assisted rather than left to implement CBC in isolation.

**Final Remark**

For CBC to move from policy intention to classroom reality, implementation must be treated as a long-term, system-wide change process rather than a one-time reform event. Addressing capacity, resources, assessment coherence, and professional learning in an integrated manner is essential if CBC is to fulfil its promise of transforming Mathematics and Science education in Zambia.

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## Appendices

### Policy Matrix

This policy Matrix presents evidence-based findings and actionable recommendations on the implementation of the Competency-Based Curriculum (CBC) in Mathematics and Science, based on triangulated data from teachers, Heads of Department (HODs), headteachers, and Subject Education Standards Officers (SESOs) in Kabwe District. The brief aims to support policy refinement, implementation planning, and resourcing decisions at national and district levels.

### Policy Matrix 1: Teacher Capacity and Professional Development

| Problem | Evidence from Study | Action Required | Responsible Body |
|---|---|---|---|
| Teachers lack deep understanding of CBC pedagogy and assessment. | Teachers, HODs, Headteachers, and SESOs all report moderate understanding, low confidence, and reliance on trial-and-error | Design and implement sustained, subject-specific CBC CPDs for Mathematics and Science | CDC; MoE; DEBS |
| CBC training is short, general, and one-off | Trainings mainly focused on lesson plan formats and orientation | Replace one-off workshops with continuous, practice- | CDC; National Science Centre; DEBS |

| | | | |
|---|---|---|---|
| | | based professional learning cycles | |
| Pre-service teacher education not aligned to CBC | SESOs report new teachers entering service unprepared for CBC | Integrate CBC pedagogy and assessment into pre-service teacher training programmes | MoE; Teacher Training Institutions |

**Policy Matrix 2: Teaching and Learning Resources**

| Problem | Evidence from Study | Action Required | Responsible Body |
|---|---|---|---|
| Severe shortage of CBC-aligned textbooks and materials | Teachers and HODs report lack of textbooks, apparatus, and instruments | Procure and distribute CBC-aligned teacher guides and learner textbooks | CDC; MoE |
| Overreliance on soft-copy modules | Schools struggle to print modules due to costs and infrastructure | Supply hard-copy syllabi and modules to all schools | CDC; MoE |
| Inadequate science laboratories and ICT facilities | HODs, Headteachers, SESOs report lack of labs, computers, and equipment | Introduce phased infrastructure upgrading for CBC, prioritising STEM subjects | MoE; DEBS |

**Policy Matrix 3: Staffing Levels and Workload**

| Problem | Evidence from Study | Action Required | Responsible Body |
|---|---|---|---|
| Shortage of Mathematics and Science teachers | SESOs and Headteachers report high teacher–pupil ratios | Recruit and equitably deploy more Mathematics and Science teachers | MoE; Teaching Service Commission |
| Excessive teacher workload | Teachers handling up to 36–40 periods per week | Introduce workload ceilings for CBC subjects | MoE; DEBS |
| Overcrowded classrooms | Class sizes often exceed 60–80 learners | Gradually reduce class sizes or introduce parallel streams | MoE; School Management |

**Policy Matrix 4: Assessment and Examination Alignment**

| Problem | Evidence from Study | Action Required | Responsible Body |
|---|---|---|---|
| Unclear competency-based assessment guidelines | Teachers and HODs unsure how to assess competencies | Develop and distribute clear assessment rubrics and exemplars | CDC; ECZ |
| Misalignment between CBC and national exams | SESOs note tension between learner-paced CBC and standardised exams | Align CBC outcomes with national assessment frameworks | CDC; ECZ; MoE |
| Inconsistent school-based assessment practices | Assessment varies widely between schools | Establish moderation and standardisation mechanisms | DEBS; SESOs |

**Policy Matrix 5: Leadership, Monitoring, and Support**

| Problem | Evidence from Study | Action Required | Responsible |
|---|---|---|---|

| | | | **Body** |
|---|---|---|---|
| Limited instructional support from districts | Schools report inconsistent SESO guidance | Train SESOs as instructional coaches rather than inspectors | MoE; DEBS |
| Weak coordination between CDC, DEBS, and schools | HODs and Headteachers cite policy–practice disconnect | Establish structured communication and feedback loops | CDC; DEBS |
| Overreliance on individual teacher initiative | Teachers improvising without system support | Institutionalise collaborative planning and mentoring structures | Schools; DEBS |

**Policy Matrix 6: Equity and Context-Sensitive Implementation**

| **Problem** | **Evidence from Study** | **Action Required** | **Responsible Body** |
|---|---|---|---|
| Urban–rural disparities in CBC implementation | SESOs highlight unequal access to resources and internet | Introduce differentiated resourcing for rural schools | MoE; DEBS |
| CBC assumptions ignore school context | Schools lack infrastructure assumed by curriculum | Allow flexible, phased CBC implementation models | CDC; MoE |
| Learner readiness gaps from primary level | Teachers and HODs report learners struggling at entry level | Strengthen CBC alignment between primary and secondary | CDC; MoE |

**Policy Matrix 7: School-Level Implementation Actions**

| **Problem** | **Evidence from Study** | **Action Required** | **Responsible Body** |
|---|---|---|---|
| Weak internal coordination for CBC | Implementation depends on few trained teachers | Institutionalise department-wide CBC planning | School Management; HODs |
| Limited time for practical and inquiry learning | Teachers constrained by timetable and workload | Protect time for practical work and reflection | School Management |
| Low teacher morale and reform fatigue | Teachers report overload and frustration | Adopt supportive monitoring and mentoring approaches | School Leadership |

**Interview Guide for HODs (Mathematics and Science)**

**Target**: HOD Maths $(n = 10)$ + HOD Science $(n = 10)$

**Mode**: Semi-structured (20 – 30 minutes)

Thank you for participating. This interview explores implementation gaps in CBC for Mathematics/Science. Participation is voluntary; responses are confidential; you may stop at any time. With your permission, I will record for accuracy.

**CORE QUESTIONS**

1. From your perspective, what does "effective CBC implementation" look like in your department?
2. How prepared are teachers in your department to implement CBC (planning, pedagogy, competency assessment)?
3. What type of CBC training/CPD has your department received, and how useful has it been?

4. What support systems exist in your department (peer support, lesson study, moderation, team planning)?
5. What resources are available for CBC implementation in your subject (materials, lab/teaching aids, ICT)? What is missing?
6. How does class size affect CBC implementation in your subject?
7. How are competencies assessed in your department? (tools, rubrics, tasks, Practicals, projects)
8. What are the most common gaps you observe between CBC policy expectations and actual classroom practice?
9. What school-level factors support or hinder CBC implementation? (timetable, leadership, supervision, funding)
10. What recommendations would you give to:
    a) CDC (curriculum clarity, guidance, exemplars)
    b) MoE/DEBS (training, monitoring, resourcing)
    c) Schools (departmental support, planning, CPD)

**Thank you for taking part in this research.**

A. **Interview Guide for Headteachers**

**Target**: Headteachers $(n = 5)$

**Focus**: School-level implementation conditions (25 – 35 minutes)

**QUESTIONS**

1. What changes has your school made to implement CBC in Mathematics and Science?
2. How do you support teacher preparedness (CPD, mentoring, monitoring)?
3. What resources are available for Maths/Science CBC implementation? How are priorities decided?
4. How does staffing (teacher numbers, workload) affect implementation?
5. How does timetable allocation support practical/inquiry learning?
6. What is the key implementation challenges you observe in Maths/Science classrooms?
7. How do departmental structures (HOD roles, meetings, CPD) function in practice?
8. What support do you receive from DEBS/SESOs, and what additional support is needed?
9. What recommendations do you have for:
    a) CDC and
    b) MoE to strengthen CBC implementation in Maths and Science?

B. **Key Informant Interview Guide for SESOs (Mathematics and Science)**

**Target: SESO Maths** $(\boldsymbol{n = 1})$ **+ SESO Science** $(\boldsymbol{n = 1})$

**Focus**: System-level implementation, monitoring, support (30 – 40 minutes)

Thank you for participating. This interview explores implementation gaps in CBC for Mathematics/Science. Participation is voluntary; responses are confidential. With your permission, I will record for accuracy.

**QUESTIONS**

1. What is the current status of CBC implementation in Mathematics/Science in Kabwe District?
2. What teacher capacity gaps are most common (curriculum interpretation, pedagogy, practical work, assessment)?
3. What training/support has been provided to schools, and what gaps remain?
4. From monitoring/supervision, what are the most common policy–practice gaps observed?
5. What resource constraints are most limiting, and how do they vary across schools?
6. How do class size and teacher workload affect Maths/Science CBC implementation district-wide?
7. What guidance materials are most needed from CDC for Maths/Science (exemplars, pacing, activities, assessment tools)?

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8. What practical recommendations would you give to:
    A. CDC (curriculum and support materials)
    B. MoE/DEBS (training systems, resourcing, monitoring)
    C. Schools (departmental planning, CPD, supervision)