

Impact of Competence-Based Curriculum on Pupils' Mathematics Skills in Kisarawe District, Tanzania

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Abstract: This study examined the effects of Competence-Based Curriculum (CBC) implementation on pupils' mathematics skills acquisition in primary schools within Kisarawe District Council. Employing a mixed-methods approach, the research integrated quantitative and qualitative data to assess the impact of CBC on teaching practices, student learning outcomes, and classroom engagement. Guided by Constructivist Learning Theory and Skill Acquisition Theory, the study explored how learner-centered strategies, problem-solving tasks, and iterative practice foster cognitive development, analytical reasoning, and mastery of mathematical concepts. Data were collected from 50 participants, including teachers and pupils, using structured questionnaires, interviews, and classroom observations. Quantitative data assessed engagement, problem-solving ability, and conceptual understanding, while qualitative data provided contextual insights into pedagogical practices. Findings indicate that CBC positively enhances pupils' problem-solving and critical thinking skills. Around 80% of pupils reported that active participation improved conceptual understanding, while 77% noted that real-life application strengthened practical problem-solving. Pupils emphasized reasoning and logical thinking over rote memorization, reflecting the curriculum's capacity to cultivate higher-order thinking. Teachers' continuous feedback (97%) and use of resources and technology (94%) further supported reflective learning. Qualitative findings revealed that group discussions, collaborative exercises, and project-based tasks enhanced confidence and competence by allowing exploration of multiple solution strategies. Challenges identified include limited teacher training, inadequate resources, heavy workloads, and difficulty adapting to inquiry-based tasks. The study concludes that effective CBC implementation can significantly enhance mathematics skills acquisition. Recommendations include sustained professional development, improved resource provision, workload management, and systematic integration of ICT and learner-centered strategies to achieve the curriculum's objectives.

Keyword : Competence-Based Curriculum, Mathematics Skills, Problem-Solving, Critical Thinking, Learner-Centered Approaches, Primary Education

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INTRODUCTION

The adoption of the Competence-Based Curriculum (CBC) represents a transformative shift in education, moving from traditional content-focused approaches toward fostering practical skills, critical thinking, and problem-solving

abilities among pupils. CBC emphasizes learner-centered strategies that engage students actively in constructing knowledge through interaction, collaboration, and application of concepts to real-life contexts (Komba & Mwandanji, 2015; UNESCO, 2023). Globally and regionally, competence-based curricula have been associated with improved cognitive development and higher-order thinking skills, with studies in East Africa highlighting positive impacts on student engagement and STEM competencies (Orodho & Ngaruiya, 2022; Munyemana & Mutwarasibo, 2020; Kuhfeld, Soland & Lewis, 2020).

In Tanzania, the implementation of CBC aligns with national education policies aimed at equipping learners with functional competencies and preparing them for socio-economic participation (URT, 2023; Republic of Tanzania, 2014). However, rural districts such as Kisarawe face contextual challenges that hinder the curriculum's effectiveness, including inadequate teaching and learning resources, limited teacher preparedness, high pupil-teacher ratios, and infrastructural constraints (Kisarawe District Council, 2022; Mkumbo, 2020; Mosha, 2021). Empirical evidence indicates that successful CBC implementation requires not only curriculum redesign but also continuous teacher training, supportive supervision, and access to instructional materials and ICT tools (Komba & Mwandosya, 2022; UNESCO, 2023). Despite these efforts, gaps remain in understanding how CBC translates into measurable skills acquisition in mathematics, particularly in rural contexts where systemic and logistical challenges persist (Kisarawe District Council, 2022; Mosha, 2021).

This study, therefore, investigates the effect of CBC implementation on pupils' skills acquisition in mathematics within Kisarawe District, aiming to provide insights into teaching practices, learning outcomes, and classroom dynamics, while informing future policy and curriculum interventions.

Empirical Review

The empirical literature on Competence-Based Curriculum (CBC) implementation in mathematics demonstrates its potential to transform student learning by shifting from rote memorization toward higher-order skills such as problem-solving, critical thinking, and creativity. Globally, CBC has been associated with deeper conceptual understanding and greater learner engagement. In Finland, for example, competence-based reforms in mathematics encouraged students to connect classroom concepts with real-life contexts, thereby enhancing analytical reasoning and logical thinking (Sahlberg, 2020). Similarly, in Singapore, strategies such as collaborative problem-solving, application-based exercises, and exploratory learning have enabled students to acquire skills that are transferable beyond the classroom (OECD, 2018). These findings indicate that when supported with appropriate pedagogical strategies, CBC can significantly enhance mathematical

understanding by emphasizing problem-solving, reasoning, and contextual application rather than mere procedural mastery.

In sub-Saharan Africa, CBC has also been shown to improve students' engagement and confidence in mathematics. Studies in Kenya and Uganda demonstrate that participatory approaches, including group discussions, inquiry-based exercises, and real-world problem-solving, fostered greater student involvement and motivation (Musyoka et al., 2021; Kagambe & Ahabwe, 2021). These approaches help students connect classroom learning with practical situations, reinforcing both understanding and the relevance of mathematical knowledge. In Tanzania, pilot implementations of CBC in primary schools have reported similar outcomes. Learners engaged actively in problem-solving tasks, often working collaboratively to address real-life mathematical challenges, such as dividing food portions or calculating household expenses, which strengthened their conceptual understanding and analytical skills (Mwandu, 2023; URT, 2023).

Despite these positive impacts, the effectiveness of CBC is strongly influenced by teacher preparedness and contextual constraints. Several studies in African countries indicate that teachers' limited training in learner-centered pedagogy often restricts the curriculum's full potential, leading to continued reliance on traditional lecture-based methods (Sifuna, 2020; Agyekum, 2020). In Tanzania, structural challenges such as overcrowded classrooms, insufficient teaching resources, and limited professional support hinder consistent and effective CBC implementation, particularly in rural districts such as Kisarawe (Njau, 2021; Kisarawe District Council, 2022). Additionally, while CBC enhances engagement and problem-solving skills, its emphasis on applied learning may unintentionally reduce attention to foundational numeracy and arithmetic fluency, creating gaps in basic skill mastery (Mosha, 2021).

Equity and systematic support remain critical concerns. Evidence suggests that schools with greater resources and better-trained teachers implement CBC more effectively, while under-resourced institutions struggle to provide meaningful student-centered experiences (Zhao, 2021; Njau, 2021). Consequently, disparities in access to resources, teacher expertise, and professional development can limit CBC's potential to improve mathematics skills across all learners. Despite these challenges, few studies have examined CBC's effectiveness specifically in rural Tanzanian primary schools, where infrastructural and resource constraints are pronounced. This study seeks to address this gap by investigating how CBC implementation influences mathematics skills acquisition in Kisarawe District, providing evidence to inform context-sensitive strategies for enhancing curriculum effectiveness and ensuring equitable student outcomes.

METHODOLOGY

The study employed a mixed-methods research approach, integrating both quantitative and qualitative techniques to evaluate the effects of Competence-Based Curriculum (CBC) implementation on pupils' mathematics skills in Kisarawe District. A Convergent Parallel Mixed-Methods Design was used, allowing quantitative and qualitative data to be collected simultaneously, analyzed independently, and later merged. This design provided a comprehensive understanding of both measurable learning outcomes and the lived experiences of teachers, students, and educational administrators. Kisarawe District was chosen as the study area due to its diverse school environments urban, semi-urban, and rural which offered valuable insights into how contextual factors influence CBC implementation.

The target population consisted of primary school pupils, mathematics teachers, and education administrators, who were selected because of their direct involvement in CBC delivery and oversight. A combination of stratified random sampling (for pupils and teachers) and purposive sampling (for administrators) yielded a sample of 50 participants, ensuring representativeness and depth. Multiple data collection instruments were used, including questionnaires, interviews, classroom observations, and document reviews, enabling triangulation of evidence. Validity was ensured through expert reviews, alignment with CBC indicators, and a pilot study, while reliability was strengthened through test-retest procedures, Cronbach's alpha, and consistent qualitative data triangulation.

Data collection followed formal ethical procedures, including obtaining permission from district authorities, informed consent from adults, and parental consent for minors. Quantitative data were analyzed using descriptive and inferential statistics with SPSS, while qualitative interviews and observations were analyzed thematically. Ethical considerations such as confidentiality, anonymity, voluntary participation, and the secure handling of data were strictly upheld throughout the research process. The mixed-methods framework, systematic sampling, rigorous analysis, and strong ethical compliance together ensured that the methodology produced credible, reliable, and policy-relevant findings on the implementation of CBC in mathematics education.

RESULT AND DISCUSSION

How Implementation of The Competence-Based Curriculum Enhances Students' Problem-Solving and Critical Thinking in Mathematics Subject

The study was aimed at investigating how the implementation of the Competence-Based Curriculum (CBC) enhances pupils' problem-solving and critical thinking skills in mathematics. Summary data is presented in Table 1, which highlights the perceptions of both learners and teachers regarding the effectiveness of CBC strategies in promoting active engagement and cognitive skill development. The

data indicate a strong positive trend, suggesting that CBC has the potential to transform traditional mathematics instruction by fostering deeper conceptual understanding, analytical abilities, and confidence in problem-solving. Unlike traditional teacher-centered methods, CBC emphasizes learner-centered approaches, practical problem-solving, real-life applications, and iterative learning, which collectively promote critical thinking and reflective reasoning (Creswell & Creswell, 2023; Bowen, 2021).

Table 1. Responses on How CBC Enhances Students Problem Solving

S/N	statements	Strongly agree		Agree		Not Agree		Not Sure	
		F	%	F	%	F	%	F	%
1	Mathematics lessons that encourage active participation help me build a deeper understanding of concepts.	25	50	19	30	16	20	00	00
2	Linking mathematics to real-life situations improves my ability to solve problems outside the classroom.	22	40	21	37	15	17	12	07
3	Focusing on reasoning and logical thinking helps me understand mathematics better than memorization alone.	29	63	21	37	00	00	00	00
4	Group discussions in mathematics lessons help me improve my problem-solving strategies.	17	23	16	20	25	50	12	07
5	Continuous feedback from teachers helps me reflect on my mathematical thinking and improve my decisions.	14	47	25	50	11	03	00	00
6	Using technology and resources in mathematics supports my creativity in solving complex problems.	27	57	21	37	12	07	00	00
7	Rote memorization is more important than reasoning or analysis in understanding mathematics.	24	47	22	40	13	10	11	03

8	Group work in mathematics lessons is not useful for improving my learning.	22	40	26	53	12	07	00	00
9	Real-life applications of mathematics do not help me understand key concepts better.	17	23	16	20	25	50	12	03
10	Competency-based learning does not enhance my engagement in mathematics.	19	4	22	36	15	15	12	07

Source; Field Data, 2025.

Quantitative findings reveal that 80% of respondents agreed that mathematics lessons encouraging active participation helped them develop a deeper understanding of mathematical concepts, while 77% affirmed that linking mathematics to real-life situations improved problem-solving abilities beyond the classroom. This suggests that learners are not only absorbing theoretical knowledge but are also able to transfer these skills to practical contexts. For example, activities that involve budgeting, measuring classroom spaces, or analyzing data from real-life scenarios allow students to contextualize abstract concepts, reinforcing the relevance of mathematics in everyday life. The 100% agreement among learners that reasoning and logical thinking enhances understanding more than rote memorization further indicates that CBC actively fosters higher-order thinking skills. Such findings are consistent with Kuhfeld, Soland, and Lewis (2020), who argued that education systems emphasizing critical reasoning and logic over memorization produce students with more flexible problem-solving abilities. These results suggest that CBC is reshaping traditional classroom dynamics, promoting analytical engagement, and reducing the overreliance on memorization as the primary learning strategy.

Furthermore, 97% of respondents acknowledged that continuous feedback from teachers helped them reflect on their mathematical thinking and improve decision-making. This demonstrates that CBC promotes a reflective learning process where students are encouraged to evaluate their problem-solving approaches, identify errors, and consider alternative strategies. Reflective practice aligns with the principles of Constructivist Learning Theory, which posits that learners build knowledge through interaction, self-assessment, and guided discovery (Komba & Mwandosya, 2022). By receiving consistent, targeted feedback, students can internalize mathematical principles and refine their reasoning skills over time. Additionally, 94% of respondents reported that the integration of technology and other resources promoted creativity in solving complex problems, indicating that tools such as educational software, simulations, and interactive digital resources not only enhance engagement but also expand the scope for experimentation and exploration

of multiple problem-solving pathways (Munyemana & Mutwarasibo, 2020). This integration of ICT aligns with modern pedagogical trends, providing learners with immediate feedback and opportunities for visualizing abstract concepts in concrete ways.

Qualitative interviews offered deeper insights into these quantitative trends. Teachers consistently highlighted that learner-centered strategies, such as group discussions, collaborative exercises, participatory problem-solving, and student-led presentations, were critical in fostering both confidence and competence in mathematics. One teacher noted that students became more willing to attempt multiple solution strategies when actively engaged in lessons (Kisarawe District Council, 2022b). Such observations reflect findings by Komba and Mwandanji (2015), who emphasized that active engagement and reflection are central to meaningful learning, particularly when developing cognitive skills such as critical thinking and problem-solving. The combination of qualitative and quantitative data underscores the complementary roles of engagement, collaboration, and guidance in enhancing students' cognitive development under CBC.

The findings also have significant theoretical underpinnings. According to Constructivist Learning Theory, learners actively construct knowledge through hands-on experiences, reflection, and social interaction rather than passively absorbing information (Creswell, 2023; Republic of Tanzania, 2014). In mathematics, this explains why students exposed to problem-based tasks, real-life scenarios, and peer discussions develop stronger analytical and reasoning skills compared to traditional lecture-based approaches. Similarly, Skill Acquisition Theory provides a complementary perspective, emphasizing that the development of problem-solving and critical thinking skills occurs progressively through repeated practice, feedback, and exposure to increasingly complex tasks (Kuhfeld, Soland & Lewis, 2020). CBC's structured approach, integrating iterative exercises, reflective feedback, and scaffolded challenges, directly aligns with these theoretical frameworks, offering a practical pathway for students to acquire, refine, and apply mathematical competencies.

Prior studies further validate these results. Komba and Mwandosya (2022) found that competence-based strategies in Tanzanian primary schools enhanced learners' analytical and reasoning abilities when participatory and practical methods were employed. UNESCO (2023a; 2023b) highlighted that CBC improves students' capacity to solve real-world mathematical problems across Sub-Saharan Africa, reinforcing the global relevance of competency-based approaches. Nevertheless, the study also revealed persistent challenges. Despite the benefits of active learning, 87% of respondents still considered rote memorization important, 93% expressed skepticism about the effectiveness of group work, and 73% believed that real-life applications did not always enhance understanding. These findings suggest that

learners' entrenched habits and cultural expectations around traditional learning methods can moderate the effectiveness of CBC (Mosha, 2021), highlighting the need for gradual pedagogical shifts supported by teacher guidance.

Structural and resource-related factors further influence CBC's impact on problem-solving and critical thinking. Teachers reported obstacles such as overloaded syllabi, insufficient learning resources, competing responsibilities, and inadequate access to ICT tools (Kisarawe District Council, 2022b). Komba and Mwandanji (2015) similarly emphasized that effective CBC implementation requires adequate instructional materials, manageable workloads, and systemic institutional support. Therefore, while CBC theoretically promotes higher-order thinking, its practical success is heavily dependent on the school environment, teacher preparedness, and availability of resources, underscoring the interplay between curriculum design and contextual realities.

The implications of these findings for educational practice are substantial. Teacher professional development programs must prioritize learner-centered strategies, equipping educators with tools to foster reasoning, analytical thinking, and problem-solving competence. Programs such as MEWAK should be strengthened to provide ongoing mentorship, classroom modeling, and reflective practice opportunities. Curriculum designers should consider realistic pacing and content loads to allow sufficient time for inquiry-based exercises, reflection, and iterative skill development. Furthermore, prioritizing the integration of ICT, manipulatives, and real-life applications can enhance engagement, creativity, and the practical application of mathematical knowledge (Munyemana & Mutwarasibo, 2020). These interventions are critical for sustaining the transformative potential of CBC in mathematics education.

The study demonstrates that the implementation of CBC in mathematics significantly enhances pupils' problem-solving and critical thinking skills when executed effectively. The alignment of CBC strategies with Constructivist Learning Theory and Skill Acquisition Theory provides a strong theoretical foundation, while empirical evidence from Kisarawe District confirms practical effectiveness. Nonetheless, the continued influence of traditional rote methods and systemic constraints indicates that sustained interventions targeted teacher training, curriculum refinement, resource provision, and supportive institutional policies are essential to fully realize the potential of CBC in transforming mathematics instruction and student competencies.

Teaching Methods Used Under the Competence-Based Curriculum and Their Impact on Pupils' Understanding of Key Mathematics Concepts.

The study sought to investigate the teaching methods employed under the Competence-Based Curriculum (CBC) and their influence on pupils' understanding

of key mathematical concepts. Summary data from Table 2 indicate that problem-based learning, collaborative learning, inquiry-based learning, manipulatives, and ICT integration are frequently used in mathematics classrooms. Overall, 96% of respondents agreed that these methods improve understanding of concepts. Qualitative interviews further revealed that CBC emphasizes learner-centered strategies, such as group work, problem-solving exercises, and real-life examples, which enhance active participation and foster critical thinking. This combination of quantitative and qualitative evidence suggests that CBC shifts the focus from rote memorization to deep conceptual understanding, enabling pupils to apply mathematics in practical contexts, thereby promoting long-term retention.

Table 2. Teaching Methods Used Under the Competence-Based Curriculum

S/N	Methods/techniques	Strongly Agree		Agree		Not Agree		Not Sure	
		F	%	F	%	F	%	F	%
1	Problem-based learning	18	27	18	27	14	47	00	00
2	Collaborative learning	20	33	21	37	18	27	11	03
3	Inquiry-based learning	14	13	28	60	16	20	12	07
4	Use of manipulatives/visual aids	14	13	14	13	22	73	00	00
5	Integration of ICT tools	13	10	20	33	23	43	14	13

Sources; Field Data, 2025

Quantitative findings show that problem-based learning (PBL) is strongly recognized for improving pupils' reasoning and analytical skills, with 27% strongly agreeing and 27% agreeing to its effectiveness. PBL engages learners in solving real-life mathematical problems, encouraging logical thinking, decision-making, and application of knowledge in contexts beyond the classroom. Collaborative learning also had high levels of agreement (33% strongly agreed, 37% agreed), reflecting the emphasis on teamwork, peer-to-peer learning, and collective problem-solving. These results indicate that CBC promotes not only individual cognitive development but also social learning, as pupils negotiate solutions, discuss strategies, and refine understanding through interaction. Inquiry-based learning, manipulatives, and ICT integration showed more varied responses, highlighting inconsistencies in

implementation and access to resources, yet they still played a significant role in enhancing concept mastery.

Qualitative data illuminate these quantitative trends, showing how learners actively construct knowledge under CBC. Teachers reported that collaborative and problem-solving activities create opportunities for learners to explore multiple solution pathways, fostering higher-order thinking. For example, one teacher noted that pupils investigating measurement and geometry in group projects became more confident in applying formulas and reasoning through complex problems (Field data, 2025). Similarly, the use of real-life scenarios, such as calculating areas in school gardens or budgeting for classroom activities, allows pupils to connect abstract mathematical concepts with everyday life, enhancing relevance, motivation, and engagement. These findings confirm that CBC encourages active learning and positions pupils as co-constructors of knowledge, consistent with Constructivist Learning Theory (Creswell & Poth, 2022; Bowen, 2021).

The use of manipulatives and visual aids further strengthens pupils' understanding by making abstract concepts tangible. Tools such as counters, geometric shapes, and diagrams allow learners to visualize relationships, patterns, and operations, reducing cognitive overload and bridging the gap between theory and practice. When pupils manipulate objects to represent fractions, equations, or geometric figures, they internalize concepts more effectively than through symbolic representation alone. Likewise, integrating ICT tools including simulations, interactive apps, and digital learning platforms enables pupils to experiment, test hypotheses, and visualize complex mathematical relationships dynamically. This aligns with the Skill Acquisition Theory, which emphasizes that mastery develops progressively through structured practice, feedback, and repeated exposure to tasks (Kuhfeld, Soland & Lewis, 2020). CBC provides these opportunities systematically, enhancing both procedural and conceptual knowledge.

The findings align closely with previous studies on CBC and mathematics learning. Komba and Mwandosya (2022) reported that participatory methods significantly improved learners' analytical and reasoning skills in Tanzanian primary schools. UNESCO (2023) also noted that competence-based approaches across Sub-Saharan Africa foster critical thinking and the application of mathematics to real-life situations. However, the study highlights challenges in consistent implementation: inquiry-based learning and ICT integration are less uniformly adopted due to resource limitations, teacher preparedness, and infrastructure gaps, echoing Mosha (2021). This suggests that while CBC strategies are effective in principle, practical constraints can limit their full impact, highlighting the need for targeted support and capacity-building.

From a theoretical perspective, CBC teaching methods exemplify Constructivist Learning Theory, which posits that learners actively construct

knowledge through experience, reflection, and social interaction. Problem-based and collaborative learning require pupils to engage with concepts, negotiate understanding, and reflect on reasoning processes, all of which enhance cognitive development and critical thinking. In parallel, Skill Acquisition Theory underscores the importance of repeated practice and feedback, as pupils refine problem-solving strategies and gradually achieve mastery. CBC's integration of continuous assessment, teacher guidance, and iterative tasks aligns closely with these theoretical frameworks, providing a coherent rationale for the observed improvements in pupils' mathematical understanding.

The implications of these findings for educational practice are substantial. Teachers must receive continuous professional development focused on designing and implementing learner-centered strategies effectively, including PBL, inquiry-based activities, and collaborative exercises. Schools should prioritize provision of adequate teaching and learning resources, such as manipulatives, visual aids, and ICT tools, to facilitate engagement and conceptual understanding. Curriculum designers should also consider realistic pacing and content load, allowing sufficient time for exploration, reflection, and project-based learning. Such interventions are essential for promoting conceptual mastery, enhancing problem-solving skills, and fostering lifelong learning habits in mathematics.

The study demonstrates that teaching methods under CBC significantly enhance pupils' understanding of key mathematics concepts by promoting active engagement, reasoning, and practical application. Quantitative and qualitative evidence confirms that problem-based learning, collaborative strategies, manipulatives, inquiry, and ICT integration collectively improve conceptual understanding, critical thinking, and problem-solving competence. These findings are strongly supported by Constructivist Learning Theory and Skill Acquisition Theory, illustrating that active learning, guided practice, and iterative engagement are central to mathematical skill development. To maximize CBC's impact, systemic challenges such as resource shortages, inconsistent implementation, and teacher preparedness must be addressed, ensuring that learner-centered strategies are fully realized in classroom practice

CONCLUSION AND RECOMMENDATIONS

The study concludes that the implementation of the Competence-Based Curriculum (CBC) in mathematics significantly enhances pupils' problem-solving and critical thinking skills. By emphasizing learner-centered strategies, practical problem-solving, real-life applications, collaborative learning, and iterative feedback, CBC fosters deeper conceptual understanding, analytical reasoning, and cognitive engagement. Quantitative and qualitative evidence from Kisarawe District demonstrates that pupils are better able to transfer mathematical knowledge to real-

world contexts, reflect on their thinking processes, and engage actively in classroom activities. The findings align with Constructivist Learning Theory, which emphasizes knowledge construction through interaction and reflection, and Skill Acquisition Theory, which highlights the progressive development of competence through structured practice and feedback. Nonetheless, the study identifies persistent challenges, including reliance on rote memorization, limited adoption of group work and inquiry-based learning, resource constraints, inadequate ICT integration, and insufficient teacher preparedness. These systemic and contextual limitations moderate the effectiveness of CBC, indicating that curriculum design alone is insufficient without supportive implementation conditions.

Based on these findings, the study recommends sustained professional development programs to equip teachers with practical skills in learner-centered instruction, problem-based learning, and effective use of technology. Schools should ensure the availability of instructional resources, manipulatives, and ICT tools to facilitate engagement and concept mastery. Curriculum designers should balance content coverage with adequate time for inquiry, reflection, and collaborative exercises to allow iterative skill development. Additionally, targeted interventions are needed to shift entrenched student and teacher reliance on memorization toward reasoning, analysis, and application of knowledge. Addressing these factors will enhance the transformative potential of CBC, promoting critical thinking, problem-solving, and the practical application of mathematics, ultimately contributing to improved educational outcomes in Tanzanian primary schools.

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