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Teachers' Sensemaking, Agency and the Implementation of Core Competencies: Lessons from Ghana's Competency-based Mathematics Curriculum Reform

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Abstract. Core competencies, understood as the essential capabilities learners must develop to participate effectively in contemporary society, lie at the centre of competency-based reforms worldwide, yet many education systems struggle to realise this vision in classroom practice. This study examines how junior high mathematics teachers and curriculum developers in Ghana make sense of, and work with, these competencies. A qualitative multiple case study was conducted through interviews with six teachers and three curriculum developers and classroom observations of three teachers. Drawing on sensemaking, teacher agency, and implementation realism, the analysis explores how actors respectively interpret policy messages, exercise instructional choice, and judge what is feasible in context. Our analysis shows that while critical thinking is widely regarded as integral to mathematics, competencies such as digital literacy and cultural identity remain marginal or are viewed as difficult to embed in lessons. Teachers report using learner-centred strategies, including group work and contextual tasks, but these are constrained by perceived curriculum overload, high-stakes examination pressures, and limited resources and professional learning. The study provides an in-depth qualitative account of how core competencies are prioritised, adapted, and constrained in practice, extending existing work on teacher sensemaking in competency-based reforms in low- and middle-income contexts. Bridging curriculum aspirations and classroom realities requires sustained subject-specific professional learning, better alignment of assessment with competency goals, and stronger teacher participation in curriculum design and review.

Keywords: Competency-based curriculum reform; Core competencies; Teacher sensemaking; Implementation realism; Junior high mathematics

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1. Introduction

Education systems worldwide are adopting competency-based curricula that frame learning in terms of core competencies, sometimes described as twenty-first-century skills (Cajandig & Ledesma, 2025; Kaya et al., 2025; Moray, 2024) and as skills for life and work (National Research Council, 2012; Shekar, 2025; Watson & Burr, 2018). This reform agenda is presented as a shift from transmitting content knowledge to cultivating core competencies that enable learners to apply knowledge flexibly and solve real-world problems. It emphasises competencies over content mastery (Duong et al., 2022) and claims to prepare learners for participation in knowledge economies and civic life (Mateo-Berganza Díaz et al., 2022).

However, these promises are fragile if they are not realised in everyday lessons. Translating curricular aspirations into practice requires teachers to reinterpret reform messages, reconcile them with entrenched routines and resource constraints, and decide which elements are workable. This professional sensemaking work (Cho & Hong, 2025) is, however, unevenly supported. Research across diverse systems shows that teachers rework curriculum reforms through their own understandings, histories and working conditions, producing varied enactments and levels of fidelity (Anhalt et al., 2018; Gong et al., 2021). Ambiguous competency formulations and limited interpretive support further hinder consistent implementation and expose a recurring tension between ambitious policy rhetoric and the practical guidance offered to teachers (Braskén et al., 2019; Ehrenfeld, 2023).

Without sustained professional support, teachers struggle to turn competency-based expectations into learner-centred, meaningful tasks. Mathematics teachers, in particular, require strong pedagogical content knowledge (PCK) and adaptive instructional strategies to develop students' problem-solving and reasoning (König et al., 2017; Ortiz-Laso et al., 2023). Studies of in-service mathematics teachers' PCK suggest that, although conceptual understanding is moderate, classroom application remains constrained, suggesting a need for professional learning that explicitly connects curriculum policy to day-to-day teaching decisions (König et al., 2021; Moh'd et al., 2021).

The Ghanaian context offers a sharply focused case of these implementation dilemmas. In 2020, Ghana developed the Common Core Programme (CCP) for junior high education, with implementation beginning in the 2021/22 academic year. The CCP marked a transition to a standards-based, competency-based curriculum centred on six core competencies: Critical Thinking and Problem Solving, Creativity and Innovation, Communication and Collaboration, Cultural Identity and Global Citizenship, Digital Literacy, and Personal Development and Leadership (NaCCA, 2020). Mathematics, as a core subject, is expected to play a pivotal role in developing these competencies through reasoning, collaborative problem-solving and ICT integration.

However, some competencies, particularly Cultural Identity and Global Citizenship and Digital Literacy, depend heavily on local context, infrastructure and teaching resources, which vary widely across schools. Nationwide in-service workshops introduced the curriculum, but brief training and uneven implementation of Professional Learning Communities (PLCs) have left many teachers to interpret and operationalise the competencies largely on their own. Three years into implementation, a persistent gap between policy and practice raises critical questions about how teachers understand the CCP's competency demands and what they actually do to embed them in classroom practice.

Emerging evidence from Ghana points to divergent experiences among mathematics teachers. Some embrace the curriculum's emphasis on reasoning and problem-solving and adopt inquiry-based and cooperative approaches that appear to enhance student engagement (Addai-Mununkum & Setordzi, 2023) while others report uncertainty about the meaning and assessment of competencies and frustration with an overloaded curriculum and high-stakes examinations that continue to reward content recall rather than competency development (Aboagye & Yawson, 2020). To our knowledge, only two qualitative studies in Ghana (Danquah & Poku, 2024; Setordzi, 2023) have examined teachers' perspectives on implementing the standards-based mathematics curriculum, and there remains limited empirical work on how teachers and curriculum developers interpret, adapt and enact core competencies in mathematics instruction.

This mirrors a broader African and international pattern in which teacher sensemaking, teacher agency and the realism of implementation conditions have been acknowledged but rarely examined together in competency-based curriculum research (Akinrinola et al., 2020; Cho & Hong, 2025; Duong et al., 2022; Ndiokubwayo, 2020; Tumuheise et al., 2023; Wawire et al., 2025). The gap is consequential. Weak or uneven implementation threatens the credibility of reforms, risks widening inequalities between well-resourced and under-resourced schools, and may blunt potential gains in students' mathematical learning. However, in-depth qualitative studies that integrate these three lenses in low- and middle-income contexts remain sparse.

Against this backdrop, this study examines how junior high mathematics teachers and curriculum developers in Ghana interpret and enact the CCP core competencies, addressing an underexplored gap in how teachers' sensemaking and agency interact with implementation realism in competency-based curriculum reform. Teacher sensemaking is conceptualised as the interpretive process through which teachers construct meaning from reform messages, drawing on prior beliefs, professional routines and contextual cues. Teacher agency refers to teachers' capacity to adapt reforms, exercise professional judgement and take initiative within structural constraints such as institutional systems, policies and accountability regimes and contextual conditions such as school environments, resource availability and local social relations.

Implementation realism, meanwhile, focuses on the alignment between reform expectations and the instructional conditions, including assessment demands, time and resources, that shape what is feasible in classrooms. Bringing these perspectives together highlights teachers' interpretive and adaptive work as the central mechanism linking reform design to classroom practice, rather than treating implementation as a simple matter of compliance or resistance.

1.1 Research Objectives

The study is exploratory and interpretive in design and pursues the following objectives:

1. To analyse how junior high school mathematics teachers and curriculum developers interpret the CCP core competencies for mathematics.
2. To examine how these competencies are enacted in classroom practice and the instructional strategies teachers use to support them.
3. To identify the contextual and systemic factors that shape the feasibility of implementing the CCP competencies in mathematics classrooms in the early years of the reform; and
4. Based on these analyses, to develop a rubric-informed framework and practical recommendations to guide professional learning, instructional leadership and assessment alignment around competency-based mathematics teaching.

1.2. Research Questions

Guided by this framework, the study addresses three interrelated research questions:

1. RQ1: How do junior high school mathematics teachers and curriculum developers in Ghana interpret the CCP core competencies within the context of mathematics teaching?
2. RQ2: How are these competencies enacted in classrooms, what instructional strategies or pedagogies are used, and with what perceived effects on classroom practice and student engagement?
3. RQ3: What challenges, tensions, or contextual factors influence implementation of the CCP core competencies, and how do teachers navigate these conditions in their practice?

For clarity, we conceptualise “effects” in RQ2 as perceived effects on classroom practice and students' engagement, while “navigate” in RQ3 refers to the strategies and adaptations teachers use in response to contextual constraints. This study makes three original contributions. First, it provides one of the first in-depth qualitative analyses of CCP mathematics classrooms in Ghana, documenting how teachers prioritise, adapt and constrain the CCP core competencies in practice. Second, by combining sensemaking, teacher agency and implementation realism, the study advances a multi-level analytical lens that connects teachers' interpretive work to the structural conditions that determine reform feasibility. Third, it translates these insights into a rubric-based framework and practice-oriented recommendations that can inform professional learning, instructional leadership and assessment reform in Ghana and comparable low- and middle-income settings.

2. Literature Review

2.1 Teacher Sensemaking: Agency, Context and Interpretation

Teacher sensemaking explains how teachers interpret, negotiate and act on curriculum reforms within complex institutional environments. Drawing on Weick (1995) and Coburn (2001), it conceptualises teachers not as passive implementers but as active meaning-makers who reconstruct policy through prior beliefs, professional experience and context. Their interpretations are shaped by subject expertise, pedagogical orientation and institutional structures (Bridwell-Mitchell & Sherer, 2017; Ross, 2024; Spillane et al., 2002). Empirical studies show that reforms are rarely enacted as designed because teachers reinterpret policies to fit what is pedagogically and institutionally manageable (Bümen & Holmqvist, 2022; So et al., 2024).

Research from China, Vietnam, South Africa, Indonesia and Turkey illustrates how administrative directives, resource shortages, accountability pressures and cultural expectations shape teachers' scope for adaptation and the degree of fidelity achieved (Bantwini, 2010; Chen et al., 2024; Handayani et al., 2023; Nihayah et al., 2023; O'Leary et al., 2023; Yan, 2012). These studies show that teacher sensemaking is embedded in power relations, culture and material realities that structure both understanding and enactment, rather than being a purely cognitive or individual process.

Sensemaking is also relational and collective. Teachers work through reform meanings in collegial networks, PLCs and disciplinary teams that support shared interpretation and classroom translation (Lowell et al., 2024; Pietarinen et al., 2019). Such collaborative structures are particularly important when reforms introduce conceptual ambiguity, since dialogue can reduce uncertainty and foster coherence (Allen, 2023; Yembergenova et al., 2024). Evidence from Finland and South Korea suggests that teachers involved in collective curriculum design or reflection achieve greater conceptual clarity and higher fidelity in enactment, whereas reforms imposed without collegial interpretation tend to generate superficial compliance or mechanical reproduction (Braskén et al., 2019; Cameron, 2020; Orafi & Borg, 2009; So et al., 2024). In this sense, collaborative sensemaking can function both as a resource for deep engagement and as a site where policy messages are selectively filtered and reinterpreted.

Teacher sensemaking is closely linked to agency and ownership: when teachers co-design reforms and adapt curricula and assessments to local realities, they exhibit stronger commitment and sustain change more effectively (Chimbunde & Moreeng, 2024; Marco-Bujosa et al., 2017). When autonomy is limited, however, reform ideas are confined to existing routines and innovation is weakened (Adekanbi & Oladele, 2024; Nihayah et al., 2023). The literature therefore portrays a tension between teachers' capacity to exercise professional agency and the constraints imposed by systems, accountability and resources. At the same time, a sensemaking focus risks romanticising agency if the structural and material conditions that delimit teachers' options are not examined explicitly. Overall, teacher sensemaking is interpretive and situated, shaped by teachers' beliefs, their collaborative environments and the systemic conditions in which they work. It

explains how meanings are constructed and adapted, but it does not fully account for the constraints that determine whether those meanings can be realised in practice. Sensemaking illuminates interpretive processes, while implementation realism addresses structural feasibility; together they connect meaning-making to the practical limits of classroom action. Applied to Ghana's CCP mathematics reform, this work on sensemaking and agency underscores the need to examine how teachers and curriculum developers interpret the new core competencies and how those interpretations mediate what happens in junior high school mathematics classrooms.

2.2 Implementation Realism: Systemic Barriers and Policy-Practice Gaps

Curriculum studies consistently highlight the gap between design aspirations and implementation realities. Implementation realism captures this divide by foregrounding the institutional, material and pedagogical conditions that determine whether reforms are achievable in practice. Fullan (2007) frames successful reform as a product of systemic coherence, in which teacher preparation, in-service support, assessment policy and school management are aligned. McLure and Aldridge (2023) similarly argue that reform effectiveness depends less on curriculum texts than on coordinated teacher learning, community engagement and leadership practices. Empirical work shows, however, that such coherence is rare. Engelbrecht (2020) and Nsengimana et al. (2024) report that reforms are often pursued amid resource shortages, weak professional support and conflicting accountability systems.

In China, Chen et al. (2024) show that centralised control and rigid assessment regimes constrain teacher agency, while Christopher and Jones (2024) describe comparable tensions across Sub-Saharan Africa, where reform ambitions frequently exceed institutional capacity and the rhetoric of innovation outpaces the restructuring of conditions on the ground. High-stakes examinations remain a persistent barrier to implementation. Chen et al. (2024) and Nsengimana et al. (2024) show that content-heavy testing discourages inquiry-based and competency-oriented teaching with similar effects reported in Nepal, where Luitel et al. (2024) find that examination pressures and limited resources undermine reform fidelity. Within this perspective, implementation realism functions both as an analytical lens and as a reform imperative. Scholars advocate phased rollouts, resource and readiness audits and continuous feedback mechanisms to align policy design with classroom conditions (Luitel et al., 2024; Nsengimana et al., 2024).

The literature thereby shifts attention from curriculum texts to the institutional systems that sustain them, arguing that reform durability depends on systemic coherence and contextual feasibility rather than on visionary frameworks alone. But, in many low- and middle-income settings, the global discourse of competency-based reform risks becoming largely symbolic if examinations, staffing, infrastructure and class sizes remain unchanged. In Ghana, where CCP mathematics has been introduced into an assessment regime still dominated by high-stakes examinations and persistent resource inequalities, implementation

realism provides a way to analyse how teachers judge the feasibility of competency-based expectations and recalibrate their practice accordingly.

2.3 Professional Learning and Pedagogical Competence

Sustained professional learning is central to curriculum reform. Short-term workshops seldom transform practice (De Carvalho-Filho et al., 2019; Fry et al., 2025), whereas continuous, practice-based models such as coaching, mentoring and collaborative professional learning promote reflection, experimentation and shared problem-solving (Allen & Heredia, 2020; Desimone & Pak, 2017). Professional learning is conceived as an ongoing, self-regulatory process through which teachers deepen their professional knowledge, skills and dispositions to enhance teaching quality and learner outcomes. Teacher competence encompasses these integrated capacities and extends Shulman's (1986) notion of PCK to include classroom management, assessment literacy and cross-cutting capabilities such as ICT integration and socio-emotional pedagogy.

Studies show considerable variation across contexts. Teachers with strong disciplinary foundations tend to demonstrate higher pedagogical content knowledge and instructional coherence, whereas those in resource-constrained systems often struggle to enact learner-centred approaches consistently (Krauss et al., 2008; Lauermann & ten Hagen, 2021). This suggests that competence is not simply a matter of individual knowledge but is mediated by the opportunities and constraints that teachers encounter in their working environments.

Recent frameworks have sought to strengthen these competencies and align professional learning with reform intent. Pino-Fan et al. (2022) propose diagnostic tools for enhancing mathematics teaching competencies, while Lai et al. (2023) and Egara and Mosia (2025) show that embedding pedagogical preparation and mentorship within teacher education and induction improves teacher readiness. Across this body of work, the literature converges on the view that curriculum innovation depends not only on what teachers are expected to teach but also on how their professional learning is structured and supported. Coherent and iterative professional learning fosters adaptive expertise and reform fidelity, whereas fragmented or episodic efforts yield largely superficial change.

A recurring limitation, however, is that professional development is often designed generically rather than in ways that address the specific demands of competency-based mathematics, such as orchestrating learner-centred problem-solving in large classes under tight time and assessment pressures. These insights are directly relevant to CCP mathematics in Ghana, where large-scale in-service workshops and fragile PLCs have provided limited sustained, subject-specific support to teachers who are expected to operationalise the core competencies in their classrooms.

2.4 Summary

Taken together, the international and African literature suggests that competency-based reforms often place new responsibilities on teachers without offering commensurate clarity, support or systemic alignment. Studies in Rwanda, Uganda and Kenya report partial understanding of competencies, continued

reliance on traditional teaching and assessment practices and strong influence of examination and resource pressures on classroom enactment (Akinrinola et al., 2020; Ndiokubwayo et al., 2020; Tumuheise et al., 2023; Wawire, 2025). Ghana has been part of this regional wave of competency-based and standards-based reform, yet there is still little empirical work that traces how mathematics teachers and curriculum developers interpret, prioritise and adapt the CCP core competencies in day-to-day practice, or that integrates sensemaking, teacher agency and implementation realism within a single analytical frame.

Most curriculum implementation studies foreground either teachers' interpretive work or systemic constraints, which risks underestimating the interplay between meaning-making and feasibility. The integrated framework adopted here explains both how teachers interpret reform messages and how feasibility constraints recalibrate those interpretations, thereby connecting sensemaking to the practical limits of classroom action. This study addresses that gap and offers a contextually grounded account of how CCP core competencies are understood and worked with in junior high school mathematics. Figure 1 summarises the conceptual framework that links these three lenses and guides the analysis in the remainder of the paper.

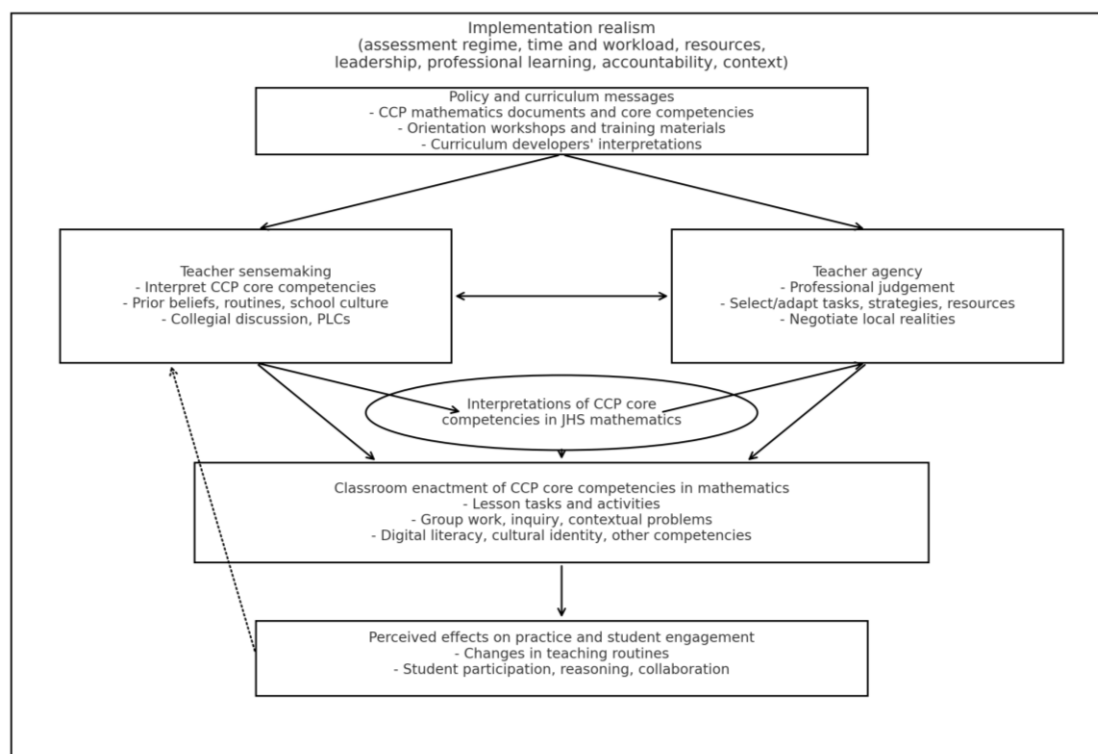


Figure 1: Conceptual framework linking teacher sensemaking, teacher agency and implementation realism in CCP junior high school mathematics classrooms in Ghana.

Note. The framework situates teachers' and curriculum developers' interpretations of CCP core competencies in junior high school mathematics within an implementation realism context. Policy and curriculum messages are interpreted through teacher sensemaking and enacted through teacher agency.

These processes are shaped by structural and material conditions and give rise to specific classroom enactments of the core competencies and perceived effects on practice and student engagement.

3. Methodology

3.1 Research Design and Participants

A qualitative multiple-case study design was adopted to examine how junior high school mathematics teachers interpret and enact the Common Core Programme (CCP) competencies in practice (Stake, 2006; Yin, 2018). Each case was defined as a mathematics teacher and their classroom, with cross-case comparison used to identify common patterns and contextual variation. The study was conducted in three public junior high schools in southern Ghana: a well-resourced urban school with functional ICT facilities, an urban school with moderate resources, and a peri-urban school with larger classes and limited ICT access. Schools and teachers were selected purposively to capture contrasting resource contexts and a range of experience profiles.

Six mathematics teachers (four male, two females, with three to twenty years of experience) and three curriculum developers from NaCCA and teacher education institutions participated, bringing classroom and policy perspectives together. The curriculum developers had been directly involved in CCP mathematics design and support. All six teachers were interviewed, and one from each school was also observed teaching. This configuration provided rich focal classroom cases while keeping the dataset manageable, consistent with guidance that adequacy in multiple-case designs is judged through depth and saturation rather than numerical size (Guest et al., 2006; Hennink et al., 2017; Patton, 2015). By the sixth teacher interview, no new substantive issues were emerging, indicating that the sample was sufficient for the study aims.

Ethical approval was obtained from the Department of Mathematics Education, University of Education, Winneba. All participants gave written informed consent and were assured that the study focused on curriculum implementation rather than individual performance. Pseudonyms (Teacher 1 to Teacher 6 for teachers and Mr Ampa, Mr Nii and Mr YB for curriculum developers) are used throughout. Given the first author's previous involvement in Ghana's curriculum reform, potential positional influence is acknowledged and addressed through the reflexive strategies outlined in Section 3.3. Table 1 summarises the characteristics of the participating teachers and curriculum developers.

Table 1: Participant characteristics

Participant	Role	Institution/Locality	Years of Experience	Gender	Interviewed / Observed
T1	Teacher	Peri-urban	3 years	Male	Interviewed + Observed
T2	Teacher	Urban	15 years	Male	Interviewed + Observed
T3	Teacher	Urban	10 years	Female	Interviewed + Observed
T4	Teacher	Urban	20+ years	Male	Interviewed
T5	Teacher	Peri urban	8 years	Male	Interviewed
T6	Teacher	Peri-urban	7 years	Female	Interviewed
CD1(Mr Ampa)	Curriculum Developer	Teacher Education Context	12years	Male	Interviewed
CD2 (Mr Nii)	Curriculum Developer	Teacher Education Context	10+ years	Male	Interviewed
CD3 (Mr YB)	Curriculum Developer	NaCCA / GES Interface	20+ years	Male	Interviewed

3.2. Instruments and Data Collection

Semi-structured interviews and classroom observations were used to investigate interpretation and classroom enactment of the CCP mathematics core competencies. The teacher interview schedule focused on understandings of the competencies, associated teaching practices and related professional learning. The curriculum developer schedule examined the intended role of the competencies and perceived implementation issues while an observation schedule documented how selected lessons reflected the competencies. All instruments were reviewed by two specialists in mathematics education and qualitative research, piloted and refined before use (Appendix 1 and Appendix 2). For the observation rubric, inter-rater agreement for independent coding of pilot lessons reached Cohen's $\kappa = 0.82$, indicating strong consistency.

Data were collected in June 2025 during the second term of the academic year, when CCP mathematics had been in place for three years and teachers had substantive implementation experience. Each participant took part in a single interview lasting 45 to 75 minutes. Interviews used open-ended prompts, were conducted in English, audio recorded with consent and transcribed verbatim. Teacher and curriculum developer interviews primarily addressed RQ1 and RQ3, while classroom observations and rubric scores provided focal evidence for RQ2. Data from curriculum developers were used to characterise the intended meanings of the CCP mathematics competencies and the broader implementation context and were not treated as evidence of classroom enactment.

To complement the interviews, classroom observations were conducted for three teachers (T1–T3) teaching 70-minute junior high school mathematics lessons on topics such as geometric transformations, probability and algebraic operations. The observation rubric, adapted from CCP mathematics curriculum materials

(NaCCA, 2020), recorded the extent to which the six CCP core competencies were evident in each lesson. Each competency was rated on a three-point scale, where 0 indicated not observed, 1 partial enactment and 2 consistent enactment across the lesson. Although all six competencies were rated, only the collaboration score was used quantitatively for cross-case comparison; the remaining ratings informed the descriptive interpretation of practice. Immediately after each lesson, analytic notes documented lesson flow, interaction patterns and key episodes of competency use.

3.3. Data Analysis

Data were analysed using a hybrid inductive and deductive approach informed by Braun and Clarke's (2006) thematic analysis. Interview transcripts and observation notes were read repeatedly for familiarisation, with brief analytic memos recording initial insights. Open coding in NVivo 12 generated data-driven codes, which were then considered alongside a priori categories derived from teacher sensemaking, teacher agency and implementation realism. Two researchers independently coded an initial subset of data, resolved discrepancies through discussion and then applied an agreed coding frame to the remaining transcripts and field notes. Codes were organised into themes and subthemes aligned with the three research questions on teachers' understanding, classroom enactment and contextual conditions.

A thematic map (Figures 2-4) was refined iteratively to check coherence and ensure that themes remained grounded in the data. Trustworthiness was enhanced through triangulation of teacher interviews, curriculum developer interviews and classroom observations to identify convergences and divergences in interpretations and practice. Additional strategies included peer debriefing between the two researchers, maintenance of an audit trail of analytic decisions and brief member checking with selected teachers. For cross-case comparison, item ratings were summarised in a single observed collaboration quality score reflecting the dominant pattern, with 2 indicating consistent structured peer interaction, 1 partial or uneven evidence and 0 no observable collaboration. Given the small number of schools and observed lessons, the study aims for analytic rather than statistical generalisation.

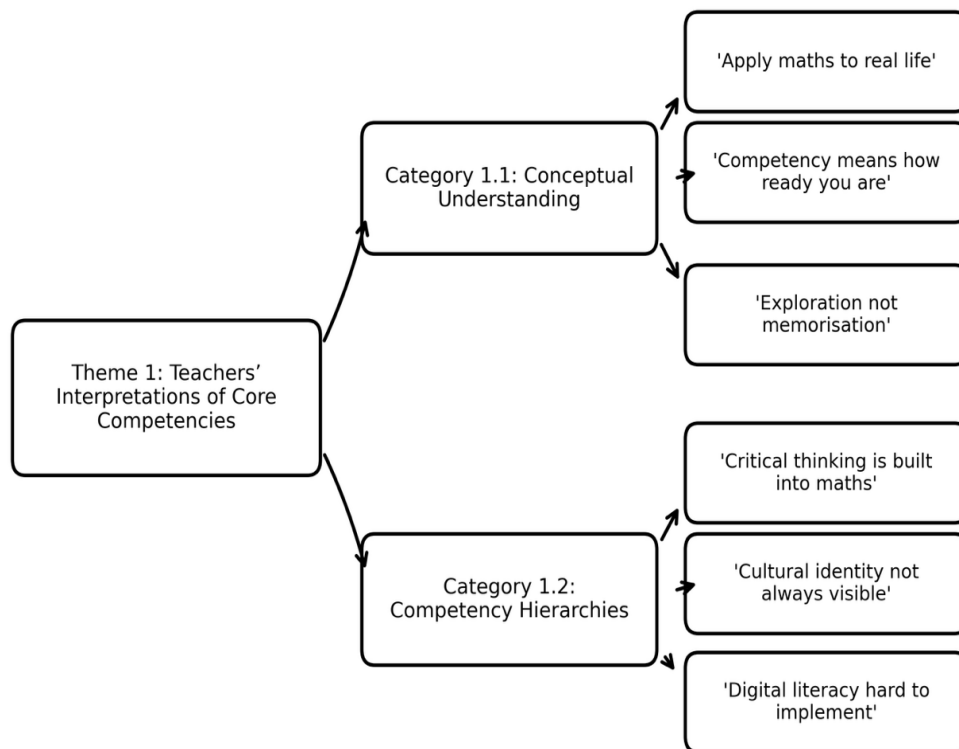


Figure 2: Thematic coding tree for teachers' interpretations of core competencies in CCP mathematics implementation (interview data)

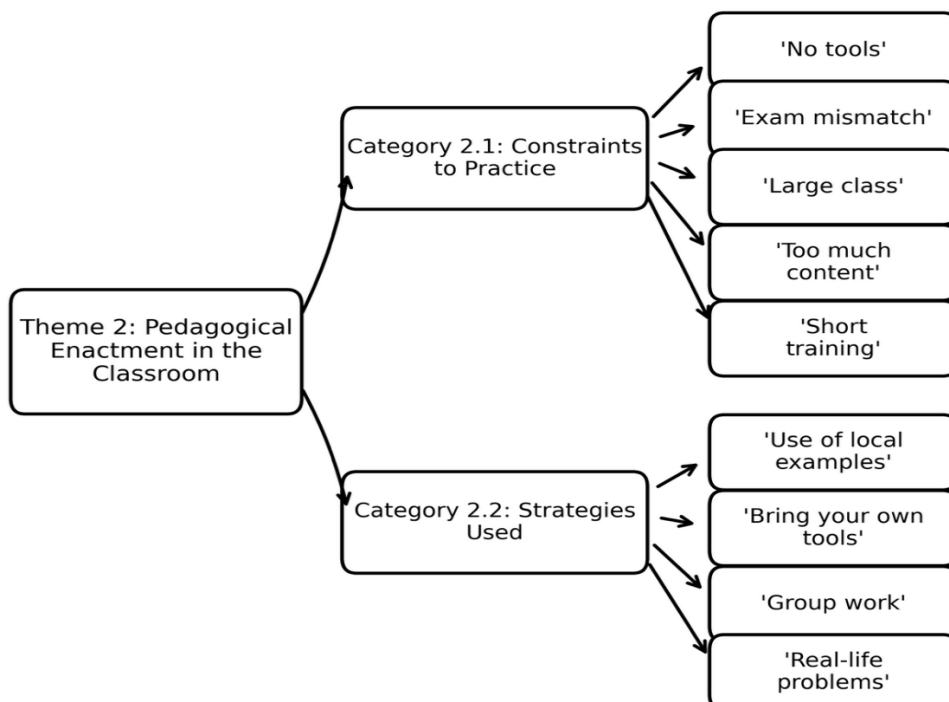


Figure 3: Thematic coding tree for teachers' classroom enactment of core competencies in CCP mathematics implementation (interview data)

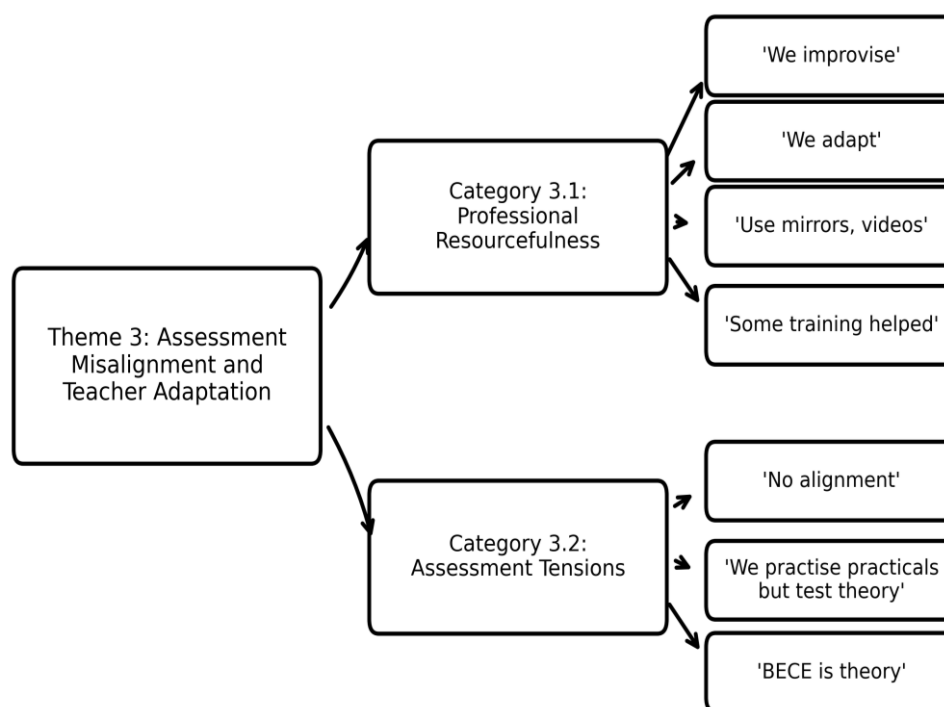


Figure 4: Thematic coding tree for contextual constraints and assessment tensions shaping CCP mathematics implementation (interview data)

3.3.1 Research Reflexivity

The first author previously worked on Ghana's curriculum reform, which could influence interpretation of the data. To reduce this risk, an external researcher conducted the teacher interviews, and the second author, who had no role in the reform, led the initial coding and theme development. The first author engaged with the coded data at a later stage to provide contextual interpretation. Ongoing discussion between the researchers and brief member checking were used to scrutinise assumptions and maintain analytic distance.

4. Results and Findings

The analysis identified three themes that mirror the research questions: (1) varied interpretations of the core competencies (teacher sensemaking); (2) translation of competencies into classroom practice (enactment strategies); and (3) systemic constraints and misalignments (implementation realism in context). Tables 2–4 summarise the cross-case patterns, which we interpret using interview extracts and observation notes to illuminate sensemaking, classroom practice and implementation.

Table 2: Theme development summary linking research questions to key findings

Research question	Theme	Defining claim	Representative quote	Corroborating observation note
RQ1: Interpretation	Varied interpretations of core competencies (teacher sensemaking)	Teachers varied in their understanding of “core competencies”, ranging from teacher-centred views of competence as teacher proficiency to learner-centred views of competence as students’ skills and attributes. This indicates initial anchoring of new terminology in familiar notions of good teaching, with gradual shifts for some.	“Core competencies [mean] how you’re able to master the subject area... how well you handle [the content] and impart the knowledge to the children”: Teacher 1, equating competencies with the teacher’s own proficiency. “Whatever you are teaching in the classroom can be implemented in real-life situations”: Teacher 3, emphasising student application of knowledge.	In class, Teacher 1 predominantly used lecture and recall questioning, for example, asking “What’s the formula for...?” to elicit choral answers. The lesson focused on content delivery, consistent with his interpretation of competency as teacher mastery.
RQ2: Enactment	Enacting competencies through student-centred pedagogies (implementation in teaching)	All teachers reported movement towards more interactive, student-engaged methods to embed competencies, although depth and effectiveness varied. Common strategies included group work, hands-on tasks, real-world examples and open-ended questioning to foster collaboration, critical thinking and, at times, creativity. Enactment was mediated by teacher skill and context, including class size and prior training.	“Through collaboration... you create an opportunity to make children think deeper, to come in with more solutions”: Teacher 2, on how group work fosters critical thinking. “I brought cardboards and we cut out shapes... it made a whole lot of sense to the learners because they were doing something physical rather than just listening”: Teacher 5, on using hands-on methods for geometry.	Teacher 2’s lesson had students in groups of about thirty with assigned roles (note-taker, presenter, etc.), actively discussing problems and engaging in peer learning. In contrast, Teacher 1’s class of nearly fifty students attempted group work, but most pupils worked individually with limited interaction, showing that group seating alone is insufficient without structure and manageable class size.
RQ3: Implementation constraints	Contextual constraints, misalignments and adaptation	Teachers faced systemic barriers that constrained full implementation of the competencies. Key challenges were curriculum overload and time pressure, large mixed-ability classes, limited resources and ICT	“The basic challenge... is time... I am not able to cover the content because much time is given to the students [to explore or discuss]”: Teacher 4, on the tension between	In one observation, Teacher 1 ended a practical activity by reverting to a past BECE question to “cover both bases”, illustrating how exam pressure pulls

		access, and assessment misalignment where the high-stakes BECE still prioritises recall. Teachers responded by selectively blending competency-oriented approaches with traditional exam preparation.	interactive methods and syllabus coverage. “The BECE questions have nothing to do with the new curriculum competencies... we are still sticking to the old. We must blend them”: Teacher 3, describing the exam gap. “We do the practical here, but they’re going to do theory in the exam... the child knows it [practically], but in the exam you have to write the theory”: Teacher 1, on the practical-exam disconnect.	teachers back to traditional exercises. In classrooms without electricity or equipment, ICT integration was effectively absent. Teachers improvised where possible, for example, Teacher 5 used string in place of measuring tapes, but saw these stopgaps as limited solutions.
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(Sources: teacher interviews and observation field notes. See text for full explanations.)

4.1 Varied Interpretations of Core Competencies in Mathematics (Sensemaking)

Table 2 shows that teachers’ understandings of the core competencies lay on a continuum between teacher-centred and learner-centred conceptions. Four of the six teachers initially framed competencies primarily as attributes of effective teaching or teacher proficiency, for example, “how you master the subject area... and impart knowledge”. Three also articulated learner-centred understandings, such as supporting students to “apply mathematics in any work given”. This distribution suggests that sensemaking was anchored first in familiar professional norms that equate competence with instructional mastery and measurable outcomes, with only a minority moving towards the curriculum’s vision of competencies as learner capabilities.

The pattern is also selective across the different competencies. Cultural Identity and Global Citizenship and Digital Literacy appear only marginally in Table 4. No teacher reported systematic integration of Cultural Identity and only two teachers, both working in better-resourced schools, regularly used ICT tools. Their limited treatment in the narrative therefore reflects their limited presence in the data rather than an analytic omission. The findings suggest that teachers have few concrete models for connecting mathematics with cultural or civic issues and that interpretations of Digital Literacy are strongly mediated by judgements about infrastructural feasibility.

In contrast, Critical Thinking and Problem Solving are reported by all six teachers and are widely described as “basic” to mathematics, providing a natural entry point for the reform. Teachers tended to read these competencies through existing emphases on reasoning and non-routine problems rather than as radically new

expectations. Overall, Theme 4.1 addresses RQ1 by showing how teachers filter new competency language through existing beliefs and material conditions, which in turn shapes the range of pedagogical possibilities they consider and the relative visibility of different competencies in classroom practice. Curriculum developers, by contrast, consistently framed the core competencies as learner capabilities, underscoring the divergence between design intent and classroom sensemaking.

4.2 Classroom Enactment of the Core Competencies

Teacher interviews and classroom observations, summarised in Tables 2 and 4, indicate that all six teachers reported at least some movement away from exclusive “chalk and talk” lessons towards more interactive, student-engaged approaches. Group work, hands-on activities and real-world examples were the most common strategies for enacting the competencies. However, both the cross-case matrix and the rubric scores for the three observed lessons show that this shift is selective and uneven. Critical Thinking and Problem Solving were consistently emphasised and evident in all three observed lessons. Collaboration and Communication were reported by four teachers, but their quality varied.

In one observed class of around thirty students, group roles were clearly structured, and peer explanations were frequent; this lesson received the highest observed collaboration score. In the larger class of nearly fifty students, collaboration quality was rated as uneven, with many pupils working individually despite group seating. In the third lesson, group structures existed, but active participation was concentrated among a subset of students. These contrasts underline that simply seating students in groups does not guarantee collaborative learning; class size, task design and the teacher’s skill in structuring interaction are critical. Creativity and Innovation were present but less robust. Three teachers described creative elements such as weekly puzzles, open-ended projects or alternative solution strategies, while the remaining teachers reported only occasional or teacher-led examples. Cultural Identity was not systematically observed in any of the three lessons, and Digital Literacy depended almost entirely on ICT access.

Only Teachers 2 and 3, working in ICT-rich environments, were able to integrate videos, software or laboratory-based demonstrations; elsewhere, Digital Literacy remained aspirational. Collectively, these patterns address RQ2 by showing that classroom enactment of the CCP competencies currently takes the form of partial implementation. Critical thinking and basic collaboration are routinely visible in teacher reports and observations, whereas creativity, cultural identity and digital literacy appear only sporadically or not at all. No observed lesson enacted the full competency set within a single session. Teachers are experimenting with learner-centred strategies, especially for reasoning and basic collaboration, yet the broader competency constellation remains fragile and highly contingent on class size, resources and teachers’ capacity to orchestrate complex activities.

The cross-case matrix in Table 4 reinforces this interpretation. All six teachers engaged Critical Thinking and Problem Solving, although one did so only partially. Four demonstrated regular Communication and Collaboration, while

two provided limited opportunities. Creativity and Innovation were strong in three classrooms, intermittent in two and absent in one. Digital Literacy was meaningfully integrated only in the two ICT-rich settings, and none of the teachers systematically embedded Cultural Identity and Global Citizenship. Across the three observed lessons, collaboration quality ranged from strong and sustained (T2, score 2), through uneven (T1, score 1), to moderate and concentrated among a subset of students (T3, score 1). These observational patterns, combined with interview accounts, show that access to ICT and wider school-level support shape the depth of competency-based enactment, even as individual initiative remains visible in teachers such as T2 and T5, highlighting how individual agency mediates what is possible under similar constraints.

4.3 Contextual Constraints, Misalignment and Adaptation

Theme 4.3, summarised in Tables 2 and 3, shows that contextual constraints strongly shaped what teachers and curriculum developers regarded as realistic. All six teachers cited time pressure and curriculum overload as major barriers, and four explicitly linked these to the need to prepare students for the high-stakes Basic Education Certificate Examination. Large, mixed-ability classes further complicated the management of group work and inquiry activities, leading some teachers to revert to more directive teaching “to carry the weaker ones along”. Resource shortages were evident for at least four teachers, who improvised with strings as measurement aids or self-funded materials. All six reported that a single week of CCP orientation, with little follow-up, was insufficient to “change your whole way of teaching”. Curriculum developers corroborated these accounts, describing the roll-out as compressed and acknowledging that sustained subject-specific support for mathematics teachers had been limited. These patterns illustrate implementation realism in action, with teachers continually weighing curriculum aspirations against pacing, manageability and resource limits. Assessment emerged as the most consequential misalignment. Table 3 juxtaposes selected 2025 BECE items with reworked versions aligned with the competencies.

Table 3: Examples of assessment misalignment and potential re-alignment

Relevant CCP Core Competence	Representative 2025 BECE Item Type	Limitations of the Current Item	Revised Competency-Aligned Item Prompt
Critical Thinking and Problem Solving (CP)	“If $1/y = 3k - 2/x$, make y the subject of the relation and find y when $x = -1$ and $k = 2$ ”.	Mostly manipulation	“Kwame claims that when x is negative and $k = 2$, y must always be positive in the relation $1/y = 3k - 2/x$. Do you agree. Justify your reasoning by showing and explaining your steps.”
Creativity and Innovation (CI)	“Evaluate $4000 \times 0.35 \div 0.05$, leaving your answer in standard form”.	Direct computation; ignores multiple representations.	“A bottling company has 4000L of drink. Only 35 percent of the drink is to be packaged into cans of capacity 0.05L. Explain two different ways to find how many cans are needed and

			<i>express your final answer in standard form</i> ".
Communication and Collaboration (CC)	<i>"Given that $P = \{\text{multiples of } 3\}$ and $Q = \{\text{positive even numbers}\}$ are subsets of $\mu = \{x : 1 \leq x \leq 20, x \text{ is a counting number}\}$, list the elements in $P \cap Q$".</i>	Listing without justification	<i>"Two pupils disagree about which numbers belong to both P and Q. List $P \cap Q$ and write a brief explanation showing why each number you listed belongs to both sets".</i>

The existing items emphasise procedural manipulation and recall, with "nothing to do with the new curriculum competencies", as one teacher put it, so teachers feel they "have to blend" activity-based lessons with intensive exam drilling. Curriculum developers recognised the issue, with Mr. YB describing assessment as "the elephant in the room", indicating that the BECE has not yet been reoriented towards competency-based outcomes.

The convergence between teachers' and developers' accounts indicates that both groups view assessment misalignment as the central barrier to realising the CCP's competency ambitions. Teachers' adaptive response is pragmatic: when time and conditions permit, they emphasise competency-oriented, learner-centred approaches, but as the BECE approaches they narrow their focus to exam-style tasks, sometimes ending otherwise interactive lessons with past questions "to cover both bases". This pattern addresses RQ3 by showing how systemic constraints and assessment misalignment push teachers towards compromise and create a long-term risk that competency-based practices will remain peripheral rather than central in Ghanaian mathematics classrooms, at least in the kinds of schools studied here.

Table 4: Cross-case matrix of teacher implementation of core competencies

TCR	CTPS	CC	CI	CIGC	DLIT	ICTA	EXSTRAT	Observed Collaboration Quality (0-2)
T1	Yes - emphasises problem-solving tasks.	Yes - uses group work occasionally; mostly traditional Q&A.	No - no notable creative tasks.	No - no cultural context used.	No - no ICT tools (no power or computers).	None (no electricity)	Group work with mirrors for geometry (hands-on demo).	1 - attempted, but limited engagement.
T2	Yes - regularly poses non-routine problems.	Yes - structured roles; strong student explanation	Yes - weekly puzzles ("creative challenge").	No - not explicitly incorporated	Yes - high; computer lab and videos.	High (lab & projector)	Structured group investigation in transformat	2 - highly interactive group work.

		ons and presentat ions.		orated .			ions (ICT-supported).	
T3	Yes - uses real-life applications and challenging questions.	Yes - think-pair-share; group exploration of concepts.	Some - occasional alternative solutions.	No - rare cultural connections.	Yes - uses mathematics software/tools.	High (lab & training)	Think-pair-share for probability introduction.	1 - moderate; some students not engaged.
T4	Yes - treats critical thinking as basic in mathematics.	Some - occasional group tasks; participation partly teacher-led.	Yes - varied examples and games.	No - no cultural references.	No - minimal /no ICT.	Low	Problem-based starter activity.	N/A (not observed)
T5	Yes - regular problem-based learning.	Yes - strong peer sharing; students present work.	Yes - open-ended projects (poster, board game).	No - no cultural integration.	No - no ICT; intermittent electricity.	Low	Student-designed poster to teach a concept.	N/A (not observed)
T6	Some - occasional reasoning prompts; mostly procedural tasks.	Some - interview mentions group work, but observation shows minimal collaboration.	Some - values innovation, but tasks follow teacher-modelled examples.	No - no cultural references used.	No - no ICT tools; textbook only.	None - no ICT infrastructure.	Demonstration of transformations followed by individual practice.	N/A (not observed)

Note. TCR = Teacher; CLSZ = Class Size; CTPS = Critical Thinking and Problem Solving; CC = Communication and Collaboration; CI = Creativity and Innovation; CIGC = Cultural Identity and Global Citizenship; DLIT = Digital Literacy; ICTA = ICT Access; EXSTRAT = Example Strategy Used. "Yes" = competency clearly evident; "Some" = partially evident; "No" = not evident. Observed Collaboration Quality (0-2) summarises rubric scores for the three observed lessons only (T1-T3), where 0 = none, 1 = uneven and 2 = strong. For teachers who were interviewed but not observed (T4-T6), this column is marked 'Not observed'.

5. Discussion

This study examined how junior high mathematics teachers and curriculum developers interpret and enact the CCP core competencies, yielding insights that extend sensemaking theory and implementation realism. The discussion is organised around three lenses aligned with the research questions: teacher

sensemaking and agency, systemic misalignment in assessment and support, and implications for professional learning and policy

5.1 Teacher Sensemaking and Agency in Curriculum Implementation

Teachers' interpretations of the CCP competencies evolved along a continuum from assimilation to reframing. Many initially equated competencies with effective teaching or content mastery, describing them as "how you master the subject area and impart knowledge", reflecting a long-standing orientation that locates competence in teachers rather than learners. Over time some reinterpreted competencies as learner capacities for applying mathematics in real-world contexts. The reform was described as "opening our eyes", signalling movement from procedural teaching to meaning-making, although several teachers retained predominantly teacher-centred understandings, indicating that policy language alone does not guarantee conceptual change.

This pattern is consistent with sensemaking accounts in which teachers construct policy meaning through existing instructional logics and gradually adjust towards reform intent (Addai-Mununkum & Setordzi, 2023; Braskén et al., 2019; Bümen & Holmqvist, 2022; Coburn, 2001; Setordzi, 2023; Spillane et al., 2002; Weick, 1995). In this study, the shift was visible in teachers' growing recognition of critical thinking and collaboration as central to mathematics and in their use of group work, inquiry tasks and hands-on activities, although with uneven depth. Sensemaking needs to be read alongside implementation realism: reinterpretations are necessary but not sufficient, because systemic feasibility ultimately determines whether competency-based ambitions are realised in practice. Teacher agency also featured prominently. Defined as the capacity to act purposefully and make informed instructional choices (Priestley et al., 2015), agency was evident in teachers' improvisation with local materials, integration of familiar strategies and adaptation of lessons to meet both competency-based and examination goals. These practices exemplify street-level bureaucracy (Lipsky, 1980), where practitioners mediate reform ideals within resource and institutional limits. Narratives of creative improvisation, however, also risk romanticising workarounds that leave structural problems unaddressed, since what appears as professional ingenuity can signal a system that relies on individual heroism rather than guaranteed minimum conditions across classrooms.

Teachers did not reject the reform. Even those sceptical of its practicality implemented aspects they found useful, particularly group work and discussion-based methods. Their selective engagement, emphasising Critical Thinking and Collaboration while struggling with Digital Literacy and Cultural Identity, reflects rational adaptation rather than resistance, echoing evidence that reform elements aligned with existing practice are more readily adopted (Bridwell-Mitchell & Sherer, 2017; Niss & Højgaard, 2019). However, the data cannot fully disentangle principled professional judgement from attachment to familiar routines, so some appeals to feasibility may also protect established practices. When supported through professional development, resources and participatory curriculum design, agency can drive reform coherence (Desimone & Pak, 2017; Fullan, 2007).

Taken together, these patterns answer RQ1 by showing that teachers move from teacher-centred to more learner-oriented understandings of the CCP competencies and selectively enact those they judge feasible. The initially teacher-centric reading of “competence” emerges as a counter-intuitive finding that challenges policy assumptions about how competency language will be understood and cautions against assuming that conceptual change will follow automatically from curriculum reform.

5.2 Systemic Misalignments in Assessment and Support

A key issue is the misalignment between Ghana’s competency-based curriculum, assessment and professional learning systems. This disconnects risks turning reform into rhetoric, strong in policy but weak in classroom reality. Teachers’ remarks that the BECE “has nothing to do with the new curriculum” illustrate how assessment continues to dictate instruction. As long as examinations reward memorisation and procedural accuracy, teachers will teach to the test (Au, 2011; Pellegrino, 2017), thus aligning assessment with competencies is critical for genuine reform (Lavonen, 2021).

These misalignments mirror patterns reported in Kenya and Rwanda, where competency-based reforms are constrained by examination logics and fragile professional learning structures (Akinrinola et al., 2020; Ndiokubwayo, 2020; Tumuheise et al., 2023). The Ghanaian case is distinctive in the singular dominance of the BECE and the relative weakness of subject-specific PLCs, which leave mathematics teachers with few institutional spaces to reinterpret the reform. The strong explanatory weight given to examinations in teachers’ accounts may also obscure the role of entrenched pedagogical cultures, since even with better alignment some teachers might continue to prioritise familiar routines unless professional learning explicitly engages beliefs and identities.

Professional learning and teacher support remain weak. One-off workshops were seen as superficial and detached from classroom needs, instead teachers called for sustained, subject-specific guidance on integrating competencies into lessons, echoing the view that effective professional learning must be continuous, collaborative and content-focused (Darling-Hammond et al., 2017; Desimone & Garet, 2015). Although PLCs have been introduced, many are inactive because of inconsistent facilitation and competing duties. Studies show that well-structured PLCs grounded in reflective lesson study can promote lasting pedagogical improvement (Buenrostro & Ehrenfeld, 2023; Sliwka et al., 2024).

Implementation was further shaped by school-level conditions such as class size, availability of teaching resources and leadership support. Some schools were better positioned to adopt the reform than others, reaffirming Fullan’s (2007) argument that system coherence, understood as alignment among curriculum, assessment and professional learning, is essential. Without such coherence, the reform risks widening existing inequalities, as students in under-resourced schools remain disadvantaged. One alternative reading is that current patterns reflect an early reform stage in which teachers cautiously trial a limited set of strategies and have not yet consolidated new routines. While this temporal

explanation is plausible, the convergence of interview and observation data across schools suggests that structural misalignments in assessment, professional learning and resourcing are the primary reasons that implementation remains partial, rather than a transient feature of early adoption.

Within these constraints, teachers still exercised notable professional agency. They adapted tasks, improvised materials and reframed lesson goals to maintain learner engagement despite systemic limits, demonstrating the micro-level resourcefulness through which reform viability is sustained in practice, consistent with Lipsky's (1980) account of street-level bureaucracy. The reliance on interview self-reports nevertheless means that the depth and frequency of competency-based practices may be overstated, and the observed lessons arguably provide an upper-bound estimate of enactment under supportive observation conditions.

Teachers' reflections that "we are doing it, but the system is not helping us" therefore capture both real structural barriers and the limits of what qualitative case evidence can conclusively show. Without coherent assessment, continuous professional learning and equitable resourcing, teachers may revert to traditional practices when enthusiasm fades. Addressing these systemic misalignments is vital if Ghana's competency-based curriculum is to move from policy aspiration to sustained classroom practice.

5.3 Implications for Professional Learning and Policy

Guided by teacher sensemaking, teacher agency and implementation realism, we propose eight actions for practice and policy, ranked by combined urgency, feasibility and likely impact. Early actions use existing structures and modest resources, while later actions require stronger political commitment but are critical for durable competency-based mathematics reform.

1. **Issue interim assessment guidance.** Within one year, NaCCA and GES should provide an interim CCP mathematics assessment guide with sample tasks and rubrics aligned to the core competencies and to the observation rubric used in this study.
2. **Revitalise mathematics PLCs.** Over the next year, district directorates and headteachers should revitalise mathematics PLCs and lesson study around the competency rubric, using teacher networks such as WhatsApp groups and lead teachers as mentors, with the aim that most junior high school mathematics teachers participate in at least one PLC cycle per term.
3. **Institutionalise teacher feedback loops.** In the short term, NaCCA and GES should establish CCP forums, surveys and targeted classroom visits to gather teachers' interpretations of competencies and assessment demands and use this feedback to adjust curriculum materials and training.
4. **Strengthen instructional leadership.** Within one to three years, GES should prepare headteachers and curriculum leads for instructional leadership in competency-based mathematics, including informed use of the rubric, protection of PLC time and mediation of examination pressures.
5. **Co-create a CCP Mathematics Teaching Handbook.** Over one to three years, NaCCA, universities, colleges of education and practising teachers should co-

- design a concise handbook that turns the teaching and observation rubrics into locally relevant planning templates, exemplar tasks and reflection prompts.
6. **Target resources to under-resourced schools.** Over three to five years, the Ministry of Education, district assemblies and development partners should prioritise digital tools and basic mathematics materials for the most under-resourced schools, where digital literacy and cultural identity competencies are most at risk.
 7. **Phase in competency-oriented BECE items.** Over three to five years, the Ministry of Education and WAEC, working with NaCCA, should phase in BECE items that require explanation, justification, collaboration and use of contextual data, beginning with pilots in a small number of districts before national roll-out, with an indicative target that, by Year 3, a visible minority of items assess reasoning and application.
 8. **Conduct readiness audits and sequence implementation.** Over the next five years, the Ministry of Education should conduct readiness audits of class size, resources and professional learning structures and use these to sequence CCP mathematics implementation so that expectations match capacity.

Together, these actions respond to fiscal and capacity constraints and to the politics of assessment. Early steps rely on existing structures and low additional cost, while later actions would require dedicated funding, technical assessment teams and a regular joint Ministry of Education–NaCCA–GES–WAEC review using indicators such as PLC participation, competency-focused lesson observations and BECE item profiles. Throughout, teachers’ interpretations, professional communities and working conditions remain central to efforts to translate competency-based mathematics policy into everyday classroom practice.

5.3.1 From Evidence to Rubrics: Translating Findings into Practice Tools

A further implication concerns the translation of the study’s evidence into practical tools for teachers, mentors and instructional leaders. The observation rubric developed for this research distilled specific teacher behaviours and student actions that signal the presence of each core competency. These indicators can be used to construct a simple rubric that supports lesson planning, classroom observation and performance assessment. Table 3 presents an illustrative rubric in which each competency is rated on a three-point scale from 0 to 2, with descriptors that make expected practices explicit.

Table 1: Illustrative rubric for competency-oriented mathematics teaching

Competency	Observable teacher behaviours	Observable student evidence	Rating descriptors (0–2)
Critical thinking and problem-solving	Poses non-routine, open-ended problems for students. Asks “why” and “how” follow-up questions that prompt reasoning. Encourages multiple solution strategies.	Students attempt more than one method. Students explain their reasoning or show steps, not just final answers. Students persist with challenging problems.	0: Only routine, procedural tasks. 1: At least one higher-order problem or “why” question, with limited reasoning. 2: Multiple reasoning tasks with many students explaining why and how.

Competency	Observable teacher behaviours	Observable student evidence	Rating descriptors (0–2)
Collaboration	Organises students into pairs or groups for tasks. Sets roles or norms for group work. Monitors and facilitates group interactions.	Students work together on tasks, discussing problems and helping one another. Most group members participate. Joint products, such as shared solutions or presentations, are evident.	0: No collaborative activity. 1: Group work is superficial or dominated by one student. 2: Active collaboration with broad participation and shared responsibility.
Communication	Invites students to explain ideas or solutions. Encourages use of mathematical language. Provides prompts that support students to articulate reasoning.	Students present methods to peers. Students ask questions or respond to others' ideas. Explanations include mathematical terms.	0: No student explanations beyond brief responses. 1: Occasional extended student responses, with discourse mainly teacher-led. 2: Frequent student explanations and exchanges, including student–student discussion.
Creativity and innovation	Sets tasks with multiple approaches or open outcomes. Values unusual strategies and discusses them. Uses creative contexts or games in lessons.	Students generate different solution methods or produce artefacts such as posters or models. Students take the initiative to try novel approaches. Visible variety in solutions and presentations.	0: All tasks are closed with single procedures. 1: Some opportunity for choice or originality, but most work is routine. 2: Clear engagement in creative tasks or projects with varied solutions.
Cultural identity and global citizenship	Uses local or global contexts in problems. Links mathematics to societal issues such as markets, nutrition or patterns. Encourages respect for diverse contributions.	Students recognise or discuss connections between mathematics and their community or wider issues. Students bring in contextual examples when prompted.	0: No cultural or real-world context. 1: Token use of local names or simple contexts. 2: Lesson explicitly rooted in local or global contexts, with clear connections made by students.
Digital literacy	Uses ICT tools such as dynamic software, videos or presentations. Involves students in interacting with technology where possible. Shows how digital tools can support mathematical work.	Students use or respond to digital tools as part of the lesson, for example calculators, simulations or projected software outputs. Students demonstrate basic ICT skills in context.	0: No use or mention of technology. 1: Teacher uses some technology, with students mainly passive. 2: Interactive use of technology by teacher and students that clearly enhances visualisation or engagement.

Such rubrics provide a common language for reflection and feedback and make improvement goals concrete. A teacher may, for example, aim to move from 1 to 2 on Collaboration by introducing structured group roles and ensuring that most

students participate, rather than responding to a general call to “teach competencies”. In this way, the rubric embodies teacher sensemaking and implementation realism by linking abstract curriculum expectations to observable practice and by offering a realistic tool that schools can adapt and refine as part of ongoing professional learning.

6. Conclusion

This study examined how junior high school mathematics teachers and curriculum developers in Ghana interpret and enact the Common Core Programme core competencies in classroom practice. Teachers’ understandings ranged from viewing competencies as extensions of existing routines to more learner-centred views that emphasise reasoning, application and collaboration. In classrooms, many shifted towards group work and inquiry tasks that foster critical thinking, yet these moves remained uneven because assessment, resources and professional learning were poorly aligned with the reform. Using sensemaking, teacher agency and implementation realism, understood as the fit between reform expectations and classroom conditions, the study shows how actors judge feasibility, adapt reforms and reconcile policy demands with classroom realities. Teachers’ improvisation with limited materials and blending of competency-oriented activities with examination preparation, captured in the remark that “the little you have, you should make use of it”, illustrates professional resilience amid structural constraints. The credibility of Ghana’s competency-based reform therefore depends less on curriculum texts than on whether such negotiations can occur under more supportive conditions.

The findings point to three priorities. Sustained professional learning is required to help teachers embed all CCP competencies, including Cultural Identity and Digital Literacy. National and school-based assessments must be realigned so that high-stakes examinations reward reasoning and problem-solving rather than procedural recall. Resource allocation and school support should prioritise under-resourced schools, including ICT infrastructure and low-cost materials for group and inquiry work. The study is limited by its small southern Ghana sample and cross-sectional design; future longitudinal and cross-regional research could validate the observation rubric and track how implementation and learner outcomes respond to changes in assessment and support. Overall, Ghana and comparable African systems show that competency-based reforms take root only when curricular design is matched by coherent assessment, targeted professional learning and attention to implementation realism.

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Appendix 1 (Interview)

Instrument for Data Collection

Study Title: *Embedding Core Competencies in Mathematics Education: A Critical Analysis of Ghana's Common Core Curriculum*

Part A: Semi-Structured Interview Protocol

Target Participants:

- Curriculum Developers
- Teacher Educators / Coordinators
- Junior High School Mathematics Teachers

Introduction (To be read aloud to the participant): Thank you for agreeing to participate in this interview. This study explores how Ghana's Common Core Programme (CCP) mathematics curriculum integrates core competencies such as critical thinking, collaboration, creativity, and digital literacy. I would like to ask you a few questions about your understanding, experiences, and views on these competencies in the context of your work. Your responses will remain confidential. You are free to skip any question or stop at any time.

Section 1: Understanding of Core Competencies

1. In your own words, what do the "core competencies" mean in the context of teaching mathematics?
2. Describe the core competencies emphasised in the CCP mathematics curriculum?
3. In your own words, what does "critical thinking" mean when teaching mathematics?
4. How do you interpret "creativity" in a mathematics context in your own words?
5. How relevant do you think "collaboration" or "communication" are in mathematics instruction?
6. Do you feel any of the competencies are more difficult to apply in math than others? Why?
7. Which of the core competencies do you believe are most naturally connected to mathematics, and why?
8. Are there any competencies that you find difficult to understand or hard to relate to math? Please explain with examples.

Section 2: Curriculum Design and Clarity (*for curriculum developers and educators*)

9. During the development of the CCP mathematics curriculum, how were competencies integrated?
10. How does the curriculum align the core competencies with specific topics or standards?
11. Do you believe the curriculum provides sufficient guidance to teachers on implementation?
12. How clearly does the CCP mathematics curriculum explain what teachers should do to develop these competencies in students?
13. Are there parts of the curriculum or syllabus that help you plan competency-based lessons? Can you give examples?
14. Are there any parts you find vague or confusing when it comes to integrating competencies?

Section 3: Instructional Practice (*for teachers*)

15. Can you describe a recent mathematics lesson where you tried to incorporate a core competency? What did you do, and how did students respond?
16. What teaching methods, activities, or tools do you usually use to promote competencies like critical thinking, collaboration, creativity, and digital literacy in your math classroom?
17. Do you use any group work, projects, or technology-based activities to enhance competencies?
18. Have you tried project-based learning, investigations, or real-world tasks to develop competencies? If yes, what worked well or not?

Section 4: Challenges and Support

19. What challenges have you faced in trying to integrate core competencies into your teaching practice?
20. How has class size, student ability, or syllabus pressure affected your efforts?
21. Have you received any training or resources specifically to support competency-based teaching?
22. What kind of support (training, resources, time, etc.) would help you implement competencies better?
23. Are there any systemic or structural issues (e.g., exam pressure, time constraints, large class sizes) that make it difficult to teach competencies?
24. How do your students respond when you use more interactive or exploratory methods in class?

Section 5: Supports and Training

25. What training or professional development have you received on the CCP curriculum and teaching for competencies?
26. In your view, was the training sufficient to help you feel confident in applying these competencies? Why or why not?

27. What kinds of additional support, resources, or ongoing training would help you implement the competencies more effectively?

Section 6: Perceived Impact and Attitudes

28. Do you think integrating these competencies has improved your students' learning or engagement in math? Please explain.
29. How do you personally feel about this shift toward a competency-based approach in mathematics teaching?
30. Do you think this approach aligns with how students are assessed, particularly with exams like the BECE?

Section 7: Reflections and Recommendations

31. In your opinion, is competency-based education suitable for mathematics in the Ghanaian context?
32. Based on your experience, what recommendations would you give to:
- a) Curriculum developers
 - b) School leaders or training facilitators
 - c) Fellow mathematics teachers...to better embed and support core competencies in math teaching?
33. Would you recommend this model for other countries or contexts?
34. If you had the power to revise the curriculum or the training program, what changes would you make to make competency-based teaching more realistic or effective?

Appendix 2 (Observations)

Instrument for Data Collection: CCP Mathematics Lesson Observation Rubric

Study Title: *Embedding Core Competencies in Mathematics Education: A Critical Analysis of Ghana's Common Core Curriculum*

Observation Details

School Name:

Class Level:

Date:

Observer (s):

Lesson Topic:

Duration:

Scoring Key

0 – Not Observed: No evidence of the behaviour or activity

1 – Partially Observed: Some evidence, but limited or inconsistent.

2 – Fully Observed: Clear, consistent presence of the competency throughout the lesson

Note: Brief qualitative notes should support each score.

Part B: Structured Classroom Observation Rubric

To be completed by a trained observer during a full JHS mathematics lesson

<i>Critical Thinking and Problem Solving</i>		
Indicator	Score (0 - 2)	Qualitative Note
The teacher uses open-ended questions that prompt analysis (e.g., "Why?", "How do you know?")		
Students are asked to explain or justify their reasoning		
Tasks require application to new or real-life contexts		
Students solve non-routine or real-world problems		
Multiple problem-solving strategies are discussed or compared		
<i>Communication and Collaboration</i>		
Indicator	Score (0 - 2)	Qualitative Note
Students engage in group or pair work on math concepts		
Students share ideas or solve problems together		
The teacher facilitates students-to-student communication.		
Students present or explain their solutions to peers		
<i>Creativity and Innovation</i>		
Indicator	Score (0 - 2)	Qualitative Note
Students encouraged to try multiple methods		
Students are encouraged to create or generate their own problems or patterns		
Tasks allow for multiple solution paths or creative strategies		
The teacher values and highlights diverse ways of thinking		
<i>Digital Literacy (ICT Integration)</i>		
Indicator	Score (0 - 2)	Qualitative Note
ICT tools or devices are used during the lesson		
ICT tools align with learning objectives and support skill development		
The teacher integrates technology for math concepts		
Digital tools are used to enhance math understanding, not just presentation		
<i>Cultural Identity and Global Citizenship</i>		
Indicator	Score (0 - 2)	Qualitative Note

The lesson includes real-life, local, or cultural contexts in examples or problems		
Math concept is linked to community issues, global challenges, or local relevance		
Students reflect on how math concept connects to societal, environmental, or cultural topics		
Local names, currencies, or culturally relevant data are used in tasks		
<i>Personal Development and Leadership</i>		
Indicator	Score (0 - 2)	Qualitative Note
Students are given roles or responsibilities in learning (e.g., group leader, peer tutor)		
The teacher promotes perseverance, self-confidence, or initiative		
Opportunities for student-led learning or decision-making		
Students demonstrate autonomy in task approach or problem selection		
<i>Teaching-Learning Approach</i>		
Indicator	Score (0 - 2)	Qualitative Note
Lesson structure promotes student-centred learning (not only lecture-practice)		
Activities include interaction, exploration, or discovery learning		
The Teacher adapts teaching based on student responses or needs		
Evidence of reflective practice or adaptive teaching methods		
<i>General Classroom Dynamics</i>		
Indicator	Score (0 - 2)	Qualitative Note
Student engagement level (low/med/high)		
Teaching method observed (lecture, activity, etc.)		
Classroom management issues (e.g., large class size, discipline)		
Time constraints or pressure to cover the syllabus		
Resource limitations (e.g., lack of ICT tools, teaching materials)		
Teacher knowledge or confidence in implementing CCP (low/med/high)		

Additional Narrative Notes: (Write a narrative summary of the lesson, flow, materials used, student responses, and any challenges or innovations observed.)