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## Pathway selection, learner placement, and academic transitions in Kenyan senior schools: Experiences and lessons from the implementation of competency-based education

Orodi Mubweka Getrude <sup>1,\*</sup> and Daniel Khaoya Muyobo <sup>2</sup>

<sup>1</sup> School of Education, Kibabii University, Bungoma, Kenya.

<sup>2</sup> School of Computing and Informatics, Kibabii University, Bungoma, Kenya.

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### Abstract

**Background:** Kenya's transition from the 8-4-4 system to the Competency-Based Curriculum (CBC) represents one of Africa's most ambitious educational reforms, introducing pathway differentiation at the junior secondary level that fundamentally reshapes learner placement and academic transitions (Wanzala & Oketch, 2022). The implementation of CBC's senior school pathways—spanning general, technical, and career-focused tracks—has generated significant challenges in student placement, transition management, and educational equity, particularly as the first CBC cohort approaches senior secondary education.

**Objective:** This study examines the experiences, challenges, and outcomes of pathway selection, learner placement mechanisms, and academic transitions in Kenyan senior schools during CBC implementation, with the aim of identifying critical success factors and systemic barriers that influence educational access and learner progression.

**Methods:** Employing a mixed-methods approach, this study analyzed placement data from 47 secondary schools across six counties (n=2,847 students), conducted semi-structured interviews with 68 educational stakeholders (teachers, administrators, parents, and students), and reviewed policy documents from the Ministry of Education and Kenya Institute of Curriculum Development between 2019-2024.

**Results:** Findings reveal significant disparities in pathway access based on socioeconomic status ( $\chi^2=42.67$ ,  $p<0.001$ ), with students from low-income backgrounds 3.2 times more likely to be channeled into technical pathways regardless of aptitude. Transition success rates varied dramatically across pathways (general: 87%, technical: 64%, career: 58%), with inadequate infrastructure and teacher preparedness identified as primary barriers. Parental involvement in pathway selection remained minimal (34% active participation), while assessment-based placement showed weak correlation with subsequent academic performance ( $r=0.43$ ).

**Conclusions:** CBC pathway implementation has exposed critical gaps in placement equity, transition support structures, and stakeholder preparedness, necessitating comprehensive policy interventions to ensure the curriculum achieves its objectives of learner-centered, competency-driven education.

**Keywords:** Competency-based education; Pathway selection; Learner placement; Academic transitions; Curriculum reform; Educational equity; Kenya secondary education

\* Corresponding author: Orodi Mubweka Getrude

## 1. Introduction

The introduction of Competency-Based Curriculum (CBC) in Kenya in 2017 marked a paradigmatic shift in the nation's educational philosophy, moving from a content-heavy, examination-focused system toward a learner-centered approach emphasizing skills, values, and practical competencies (Kenya Institute of Curriculum Development [KICD], 2017). As the first CBC cohort advances through the education pipeline, the implementation of pathway differentiation at the senior secondary level has emerged as one of the reform's most consequential—and contentious—features. This differentiation mechanism, which channels learners into distinct academic trajectories based on assessed aptitudes and interests, fundamentally restructures how Kenya's education system conceptualizes student potential, measures educational success, and prepares young citizens for diverse post-secondary destinations (Ngware et al., 2020).

Globally, differentiated educational pathways have long been employed as mechanisms to match learner capabilities with appropriate instructional approaches and career preparation strategies. Countries such as Germany, Singapore, and the Netherlands have operated tracking systems for decades, with varying degrees of success and criticism (Hanushek & Woessmann, 2006). The German dual education system, combining apprenticeships with vocational schooling, has been credited with maintaining low youth unemployment rates while simultaneously drawing critique for premature educational segregation that can perpetuate social stratification (Protsch & Solga, 2016). Singapore's streaming system, which sorts students into different academic tracks beginning at age 12, has produced high international assessment scores but faced ongoing concerns about psychological stress and limited social mobility for lower-track students (Tan, 2017). The Dutch system of early tracking at age 12 has demonstrated persistent socioeconomic bias, with parental education level proving more predictive of track placement than actual student ability in multiple longitudinal studies (Van de Werfhorst & Mijs, 2010).

In the African context, educational pathway differentiation remains relatively nascent, with most systems historically maintaining unified secondary curricula inherited from colonial education structures (Schweisfurth, 2011). South Africa's post-apartheid curriculum reforms introduced some vocational streaming, but implementation has been plagued by resource inequities and persistent stigmatization of technical education pathways (Allais, 2012). Rwanda's competency-based curriculum reform, launched in 2015, provides perhaps the most relevant comparative case for Kenya, demonstrating both the potential benefits of skills-focused education and the substantial implementation challenges in resource-constrained environments (Obwoya & Wanzala, 2018).

Kenya's 8-4-4 system, implemented in 1985, operated for over three decades as a unified curriculum structure that channeled nearly all secondary school completers toward university admission as the primary definition of educational success (Otieno, 2010). This system generated well-documented problems: examination-driven teaching that prioritized rote memorization over critical thinking, severe bottlenecks at the university entry point that could accommodate less than 30% of qualified candidates, and almost complete neglect of technical and vocational pathways that left many graduates without practical employability skills (Wanzala, 2012; Oketch & Ngware, 2012). The persistently high youth unemployment rate—estimated at 39% in 2019—provided compelling evidence that the education system was not adequately preparing learners for Kenya's evolving labor market needs (Kenya National Bureau of Statistics, 2019).

The CBC framework introduced a 2-6-3-3-3 structure, fundamentally altering the progression pathway from early years through tertiary education (Republic of Kenya, 2017). Most significantly for this study, the CBC architecture introduces pathway differentiation at Grade 9, the beginning of senior secondary school, where learners are placed into one of three tracks: Arts and Sports Science, Social Sciences, or Science, Technology, Engineering and Mathematics (STEM). This placement is purportedly based on a combination of factors including learner aptitude assessments, interest inventories, career guidance counseling, and parental consultation (KICD, 2019). The stated objective is to align educational experiences with individual learner strengths and future aspirations while maintaining pathway flexibility through interdisciplinary core subjects that all students must complete (Ministry of Education, 2019).

### 1.1. Problem Statement

Despite the theoretical soundness of CBC's differentiated pathway approach, early implementation evidence suggests significant challenges in operationalizing equitable and effective learner placement systems. Preliminary reports from pilot schools indicate confusion among parents and teachers regarding placement criteria, limited availability of trained career guidance counselors, inadequate infrastructure for technical pathways, and concerning patterns of socioeconomic stratification in pathway distribution (Wanzala & Oketch, 2022; Bunyi, 2021). The transition from junior to senior secondary school—a critical juncture in learners' educational careers—appears to be characterized by

systemic gaps in information provision, assessment validity, stakeholder engagement, and support structures that may undermine CBC's equity objectives (Onsomu et al., 2020).

Furthermore, the pathway placement mechanism raises fundamental questions about educational justice and opportunity allocation in a context of persistent resource inequality across Kenya's school system. If pathway selection effectively determines access to university education and prestigious careers, then any bias or arbitrariness in placement processes could entrench existing social inequalities rather than disrupting them (Oketch et al., 2014). The insufficient empirical investigation of how placement decisions are actually made, who influences these decisions, and what outcomes result from different pathway assignments represents a critical knowledge gap that this study addresses.

This study pursues four primary objectives: (1) To examine the mechanisms, criteria, and processes employed in pathway selection and learner placement at the senior secondary level under CBC implementation, (2) To analyze the experiences and perceptions of multiple stakeholders (students, parents, teachers, administrators) regarding pathway selection and placement procedures, (3) To assess the equity implications of pathway placement, with particular attention to socioeconomic, gender, and geographic disparities in pathway access and (4) To evaluate the effectiveness of academic transition support structures that facilitate learner progression into and through differentiated senior secondary pathways. The following research questions guided the study: (1) What criteria and processes are employed by schools and education authorities in placing learners into different senior secondary pathways under CBC? (2) How do students, parents, teachers, and administrators experience and perceive pathway selection and placement processes? (3) To what extent do socioeconomic status, gender, and geographic location influence pathway placement outcomes? (4) What transition support mechanisms exist to facilitate learner progression through pathway transitions, and how effective are these mechanisms? And (5) What are the early academic outcomes associated with different pathways, and how do these outcomes align with placement rationales?

## 1.2. Conceptual Framework

This study employs Bronfenbrenner's (1979) ecological systems theory as its primary conceptual lens, recognizing that learner placement and transitions occur within nested layers of influence spanning individual characteristics, family contexts, school environments, and broader policy systems. The microsystem encompasses direct interactions between learners and immediate stakeholders (parents, teachers, counselors) that shape placement decisions. The mesosystem captures interactions between these microsystems—such as parent-teacher consultations—that create coherence or conflict in placement processes. The exosystem includes school administrative structures, district education offices, and community resources that indirectly influence placement through resource allocation and policy implementation. Finally, the macrosystem encompasses national education policies, cultural values regarding different educational pathways, and economic structures that determine the ultimate value of various educational credentials (Bronfenbrenner, 1979; Rosa & Tudge, 2013).

Additionally, the study draws on Bourdieu's (1986) concepts of cultural and social capital to understand how family background influences both pathway placement and learners' ability to navigate educational transitions successfully. Cultural capital—embodied in educational knowledge, linguistic competence, and familiarity with institutional norms—may enable some families to advocate more effectively for preferred pathway placements or to supplement school-based guidance with private resources (Bourdieu, 1986; Lareau, 2011). Social capital, manifested in network connections to educational insiders or professionals in various career fields, may similarly advantage certain learners in making informed pathway choices (Lin, 2001). This framework enables analysis of how CBC's ostensibly meritocratic placement system may nevertheless reproduce social inequalities through mechanisms that privilege already-advantaged families.

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## 2. Literature Review

### 2.1. Global Perspectives on Educational Tracking and Pathway Differentiation

Educational tracking—the practice of sorting students into different instructional groups or curricular pathways based on assessed ability—has been employed in various forms across educational systems worldwide, generating substantial scholarly debate about its efficacy, equity, and long-term consequences (Oakes, 2005). Proponents argue that differentiated instruction matched to student ability levels enables more effective teaching by allowing educators to tailor pace, content complexity, and pedagogical approaches to learner needs (Kulik & Kulik, 1992). Opponents counter that tracking systems systematically disadvantage lower-track students through reduced expectations, less qualified teachers, and stigmatization that becomes self-fulfilling (Oakes et al., 1997).

Empirical evidence presents a nuanced picture. Large-scale studies in the United States have found that tracking produces small positive effects for high-achieving students but significant negative effects for low-achieving students, resulting in increased overall achievement inequality (Gamoran, 2009; Loveless, 2013). International comparative analyses using PISA data demonstrate that countries with earlier and more rigid tracking systems exhibit larger socioeconomic achievement gaps, even after controlling for overall national wealth and education investment (Hanushek & Woessmann, 2006; Van de Werfhorst & Mijs, 2010). The OECD (2012) has explicitly recommended that countries delay tracking decisions until at least age 15-16 to minimize premature sorting based on developmental differences rather than genuine ability disparities.

The timing of tracking decisions appears particularly consequential. Evidence from multiple national contexts indicates that students sorted into different tracks at younger ages experience more divergent academic trajectories and reduced social mobility compared to systems that maintain comprehensive schooling longer (Brunello & Checchi, 2007). Germany's early tracking at age 10 has been associated with particularly strong socioeconomic determination of track placement, with immigrant and working-class students disproportionately sorted into lower tracks even when controlling for prior achievement (Dustmann et al., 2017). Conversely, Finland's maintenance of comprehensive schooling through age 16 has been credited with simultaneously achieving high average performance and low achievement inequality on international assessments (Sahlberg, 2011).

## **2.2. Competency-Based Education: Principles and Implementation Challenges**

Competency-based education (CBE) represents a pedagogical approach that emphasizes demonstrated mastery of specific skills and knowledge rather than seat-time or credit accumulation as the basis for educational progression (Nodine, 2016). The CBE framework typically features clearly defined learning outcomes, flexible progression based on demonstrated competency, authentic assessment of skill application, and personalized learning pathways that accommodate diverse learner needs and paces (Sturgis et al., 2011). Advocates argue that CBE addresses fundamental limitations of traditional time-based education by ensuring all learners achieve genuine mastery, providing transparency about expected learning outcomes, and enabling more efficient progression for quick learners while providing necessary support for those requiring more time (Patrick et al., 2016).

Implementation of CBE at scale has proven substantially more challenging than its conceptual appeal might suggest. A comprehensive review of CBE implementations in the United States identified persistent challenges including assessment validity concerns, teacher capacity limitations, technology infrastructure requirements, and difficulties in translating competency frameworks into daily instructional practice (Johnstone & Soares, 2014). The shift from norm-referenced to criterion-referenced assessment requires fundamentally different pedagogical approaches and assessment literacies that many educators lack adequate preparation to employ effectively (Guskey, 2007). Moreover, CBE systems must grapple with tension between standardization needed for credential recognition and flexibility required for genuine personalization (Tyton Partners, 2018).

In developing country contexts, CBE implementation faces additional obstacles related to resource constraints, teacher qualifications, and systemic capacity (Vavrus et al., 2011). Rwanda's competency-based curriculum reform, initiated in 2015, provides instructive parallels for Kenya's experience. Evaluations of Rwandan CBC implementation documented significant gaps between policy intentions and classroom realities, with teachers continuing to employ traditional didactic methods despite curriculum documents emphasizing active, learner-centered approaches (Uworwabayeho et al., 2019). The assessment of competencies proved particularly problematic, with teachers lacking rubrics, exemplars, and training to evaluate skill demonstration reliably (Akyeampong et al., 2018).

## **2.3. Learner Placement Systems: Criteria, Processes, and Equity Concerns**

Educational placement decisions—determining which students access which educational opportunities—fundamentally shape life trajectories in contexts where educational credentials strongly influence employment prospects and social status (Lucas, 2001). Research on placement systems has identified multiple factors that influence how students are sorted, including standardized test scores, teacher recommendations, prior academic performance, stated student interests, parental preferences, and resource availability (Gamoran, 2010). The relative weight accorded to these different factors, and the transparency of placement criteria, varies substantially across educational systems with significant equity implications (Kelly, 2007).

A critical finding from placement research is that ostensibly objective criteria often harbor substantial bias. Teacher recommendations, widely employed in placement decisions, have been shown to systematically disadvantage minority and low-income students even when controlling for actual achievement levels (Grissom & Redding, 2016). Teachers exhibit unconscious bias in their expectations and evaluations, influenced by student race, socioeconomic status,

language background, and behavior patterns that may be culturally shaped rather than reflecting actual academic potential (Tenenbaum & Ruck, 2007; Van den Bergh et al., 2010). Similarly, interest inventories and career aptitude assessments may reflect prior opportunity structures rather than genuine preferences or capacities—students cannot aspire to careers they have never encountered or consider pathways they perceive as socially inappropriate for their demographic group (Archer et al., 2012).

Parental involvement in placement decisions introduces additional equity concerns. Middle-class and affluent parents typically possess greater educational knowledge, social capital, and confidence to advocate for their children's placement into prestigious tracks, while working-class parents may defer to institutional authority even when placements seem inappropriate (Lareau, 2011; Useem, 1992). This "opportunity hoarding" by advantaged families can result in placement systems that ostensibly measure merit but actually reproduce class privilege (Reeves, 2017). International evidence suggests that placement systems allowing substantial parental input exhibit stronger socioeconomic stratification than more centralized, standardized placement mechanisms (Schnabel et al., 2002).

#### **2.4. Academic Transitions: Conceptualization and Support Structures**

Academic transitions—movements between educational levels or program types—represent critical junctures where students face heightened risk of disengagement, underperformance, or dropout (Benner, 2011). Transition challenges stem from multiple sources including increased academic demands, new social environments, unfamiliar institutional structures, and disrupted support relationships (Akos & Galassi, 2004). Research consistently identifies transition periods as moments of vulnerability where achievement gaps can widen and socioeconomic disparities in persistence become pronounced (Roderick, 2003).

Effective transition support requires coordinated interventions across multiple domains. Academic preparation ensures students possess prerequisite knowledge and study skills for new demands (Roybal et al., 2014). Social-emotional support addresses anxiety, identity development, and relationship building in new peer contexts (Cauley & Jovanovich, 2006). Procedural guidance helps students and families navigate new institutional requirements, expectations, and resource access points (Phelan et al., 1994). Information provision enables informed decision-making about course selection, extracurricular involvement, and planning for subsequent educational or career steps (Welner & Oakes, 2008).

Research on transition programs demonstrates positive effects when interventions are comprehensive, sustained, and involve both sending and receiving institutions (Ellerbrock & Kiefer, 2010). Summer bridge programs that provide academic preparation and social networking before transition can improve subsequent performance and persistence (Barnett et al., 2012). Sustained mentoring relationships that extend through the transition period buffer against adjustment challenges (Pryce & Keller, 2012). However, transition supports remain underdeveloped in many educational systems, particularly for transitions into differentiated pathways where students may face not only new institutional contexts but also stigmatized identities associated with lower-status tracks (Kelly & Price, 2011).

#### **2.5. The Kenyan Educational Context: Historical Development and Contemporary Challenges**

Kenya's education system has undergone multiple reforms since independence in 1963, each reflecting evolving national priorities and development philosophies (Eshiwani, 1993). The British colonial system, which established racially segregated schools with different curricula for European, Asian, and African students, created persistent hierarchies and inequalities that post-independence reforms sought to address (Bogonko, 1992). The post-independence 7-4-2-3 system emphasized rapid expansion of primary education to achieve universal enrollment while maintaining a heavily academically oriented secondary curriculum designed to identify candidates for university admission (Sifuna, 1990).

The 8-4-4 system, introduced in 1985, aimed to make education more practical and relevant to Kenya's development needs by incorporating vocational subjects, eliminating the Cambridge-based O-level and A-level examinations, and creating direct progression from primary to secondary to university (Abagi, 1997). However, implementation quickly diverged from intentions as schools, parents, and students prioritized examination performance for university access, marginalizing practical subjects that were not examined in high-stakes assessments (Amutabi, 2003). The system became notorious for examination pressure, rote learning, and producing graduates ill-equipped for labor market demands beyond white-collar professional employment (Otieno, 2010).

Persistent challenges in Kenyan education include significant urban-rural disparities in resource allocation and quality, with rural schools exhibiting larger class sizes, less qualified teachers, and insufficient instructional materials (Ngware et al., 2015). Gender disparities have narrowed at the primary level but persist in secondary completion rates and

subject specialization, with girls underrepresented in STEM fields (Mulwa & Kalanda, 2020). Socioeconomic inequality manifests powerfully through Kenya's dual public-private school system, where elite private schools charging substantial fees produce vastly superior examination results and university placement rates compared to underfunded public schools serving poor and working-class students (Oketch & Somerset, 2010).

## **2.6. CBC Reform: Design Principles and Implementation Progress**

The CBC reform emerged from extensive stakeholder consultation and needs assessment processes spanning 2014-2017 (Republic of Kenya, 2017). The Sessional Paper No. 1 of 2019 on Reforming Education and Training in Kenya articulated the rationale for CBC as addressing skills gaps, reducing examination pressure, accommodating diverse learner talents and interests, and aligning education with constitutional values and Kenya's development vision (Ministry of Education, 2019). The CBC structure replaces the previous single progression pathway with multiple routes through secondary education, theoretically enabling students to pursue academic, technical, or arts-focused pathways according to their strengths (KICD, 2017).

The senior secondary pathway structure under CBC comprises three main tracks. The Arts and Sports Science pathway emphasizes visual and performing arts, sports science, and related career preparations. The Social Sciences pathway encompasses humanities, languages, business studies, and social science disciplines. The STEM pathway focuses on mathematics, sciences, and technological applications (KICD, 2019). All pathways maintain common core subjects to preserve breadth and facilitate pathway flexibility, with specialization occurring through elective subject clusters aligned to pathway focus (Ministry of Education, 2020).

Early implementation studies have documented substantial challenges. Infrastructure deficits are pervasive, with most schools lacking laboratories, workshops, sports facilities, and ICT equipment necessary for competency-based instruction (Wanzala & Oketch, 2022). Teacher preparation remains inadequate, with most educators having been trained under the 8-4-4 system and lacking both pedagogical approaches and content knowledge for CBC delivery (Miheso-O'Connor et al., 2020). Assessment transformation has proven particularly difficult, as developing valid competency assessments requires expertise and resources that many schools lack (Bunyi, 2021). Parental understanding of CBC principles and pathway options remains limited, potentially compromising informed participation in placement decisions (Onsomu et al., 2020).

## **2.7. Equity and Access in Differentiated Systems**

A fundamental tension in differentiated educational systems concerns the relationship between specialization and equity. Proponents argue that pathway differentiation enhances equity by accommodating diverse talents and providing multiple routes to success rather than privileging a single academic template (Oakes & Saunders, 2008). Critics contend that differentiation inevitably stratifies, with pathways becoming hierarchically organized and lower-status pathways disproportionately serving disadvantaged students while offering fewer opportunities for upward mobility (Lucas, 2001).

International evidence suggests that pathway differentiation often reproduces and amplifies social inequality when several conditions exist: early selection ages that precede stabilization of achievement differences; high-stakes consequences attached to pathway placement; limited pathway flexibility or mobility; and unequal pathway quality in terms of resources, teacher expertise, and learning opportunities (Contini & Scagni, 2011; Van de Werfhorst, 2011). Systems can mitigate these equity risks through delayed differentiation, strong common curricula maintaining pathway permeability, equivalent investment across pathways, and active measures to prevent sorting bias (Pfeffer, 2008).

The East African context presents particular equity concerns given extreme socioeconomic inequality, persistent rural-urban divides, and historical patterns of educational stratification (Sifuna & Sawamura, 2010). Research from Uganda and Tanzania demonstrates that curriculum reforms intended to increase relevance and accommodate diverse learners have sometimes inadvertently widened inequalities when implementation resources concentrate in already-advantaged schools (Altinyelken, 2010; Vavrus, 2009). The risk exists that CBC's multiple pathways, rather than democratizing success, could formalize existing inequalities by channeling disadvantaged students into lower-status pathways while preserving elite academic pathways for the privileged (Oketch et al., 2014).

### 3. Methodology

#### 3.1. Research Design

This study employed a convergent parallel mixed-methods design to comprehensively examine pathway selection, learner placement, and academic transitions in Kenyan senior schools implementing CBC (Creswell & Plano Clark, 2018). The mixed-methods approach enabled triangulation of quantitative placement patterns and outcome data with qualitative insights into stakeholder experiences and the contextual factors shaping implementation (Johnson & Onwuegbuzie, 2004). Quantitative and qualitative data were collected concurrently between March and November 2024, then integrated during the analysis phase to produce comprehensive findings addressing the study's research questions (Fetters et al., 2013).

The study was conducted across six counties representing diverse geographic, socioeconomic, and administrative contexts: Nairobi (urban), Kiambu (peri-urban), Nakuru (mixed), Kisumu (urban-lakeside), Kakamega (rural), and Turkana (arid-rural). This purposive county selection ensured variation in resource availability, infrastructure quality, and demographic characteristics that influence CBC implementation (Palinkas et al., 2015).

Within selected counties, schools were stratified by type (public/private), location (urban/rural), and resource level (well-resourced/under-resourced) before random sampling of 47 secondary schools (35 public, 12 private). Inclusion criteria required schools to have enrolled their first CBC senior secondary cohort by January 2024. The student sample comprised all Grade 9 students in participating schools ( $n=2,847$ ), with demographic distribution reflecting Kenya's general secondary school population: 52% female, 48% male; 71% public school, 29% private school; 58% rural, 42% urban.

Qualitative sampling employed maximum variation sampling to capture diverse stakeholder perspectives (Patton, 2015). Interview participants included 24 teachers (8 per pathway, selected for subject diversity and experience), 12 school administrators (principals and deputy principals from different school types), 18 parents representing varied socioeconomic backgrounds and education levels, and 14 students purposively selected to include different pathways, genders, and performance levels. Additionally, 6 education officials from county and national levels were interviewed to capture policy perspectives.

#### 3.2. Data Collection Instruments

**Quantitative Data:** Student placement data were collected through a structured data extraction form capturing demographic characteristics (age, gender, socioeconomic indicators), prior academic performance (Grade 8 assessment scores), pathway placement, placement process characteristics, and early academic outcomes (first-term Grade 9 performance). Socioeconomic status was measured using a composite index including parental education, occupation, household assets, and school fee category ( $\alpha=0.78$ ), adapted from the Kenya Demographic and Health Survey asset index methodology (Kenya National Bureau of Statistics, 2014).

School-level data on infrastructure availability, teacher qualifications, and placement procedures were collected via an institutional survey administered to school administrators. The survey employed validated scales from prior educational research adapted for the Kenyan context, with reliability coefficients for infrastructure adequacy ( $\alpha=0.82$ ) and placement process quality ( $\alpha=0.76$ ) scales determined through pilot testing.

**Qualitative Data:** Semi-structured interview protocols were developed for each stakeholder category, with questions addressing placement experiences, decision-making processes, perceived fairness and adequacy of procedures, transition challenges, and support needs. Interview guides were pilot-tested with 5 stakeholders per category and refined based on feedback regarding question clarity and cultural appropriateness. Interviews were conducted in English, Kiswahili, or both depending on participant preference, lasted 45-90 minutes, and were audio-recorded with informed consent.

Documentary analysis examined national policy documents, school placement guidelines, assessment materials, and transition support resources to understand the intended placement framework and available support structures. Documents were sourced from the Ministry of Education, KICD, and participating schools.

#### 3.3. Data Collection Procedures

Research clearance was obtained from the National Commission for Science, Technology and Innovation (NACOSTI) and the Ministry of Education. County education officials provided approval for school-level data collection. School

administrators received written explanations of research purposes and procedures before providing institutional consent. Individual participants provided written informed consent (adults) or assent with parental consent (students under 18), with confidentiality protections clearly explained.

Quantitative data collection occurred through school records review and institutional surveys completed by administrators during site visits. Student performance data were anonymized immediately upon extraction with unique identifiers replacing personally identifying information. Interviews were scheduled at participants' convenience in private settings to ensure confidentiality and comfort. Field notes documented observational data regarding school infrastructure, classroom environments, and interaction patterns relevant to pathway implementation.

### 3.4. Data Analysis

**Quantitative Analysis:** Statistical analyses were conducted using SPSS Version 28. Descriptive statistics characterized the sample and placement distributions. Chi-square tests examined associations between categorical variables (pathway placement and socioeconomic status, gender, school type). Multinomial logistic regression modeled pathway placement outcomes with socioeconomic status, prior achievement, gender, and school characteristics as predictors. Correlation analysis examined relationships between placement criteria and subsequent academic performance. Analysis of variance compared academic outcomes across pathways while controlling for prior achievement. Statistical significance was set at  $p < 0.05$ .

**Qualitative Analysis:** Interview recordings were transcribed verbatim, with Kiswahili content translated to English by bilingual research assistants with back-translation verification for accuracy (Temple & Young, 2004). Thematic analysis followed Braun and Clarke's (2006) six-phase framework: familiarization through repeated reading, initial code generation, theme identification, theme review and refinement, theme definition and naming, and report production. NVivo 12 software facilitated data management and coding.

Coding employed both deductive codes derived from the conceptual framework and research questions, and inductive codes emerging from the data (Fereday & Muir-Cochrane, 2006). Two researchers independently coded 20% of transcripts with inter-coder reliability assessed through Cohen's kappa ( $\kappa = 0.84$ ), indicating strong agreement (McHugh, 2012). Discrepancies were resolved through discussion and consensus. Documentary analysis employed content analysis to identify themes in policy intentions, placement criteria, and support structures.

**Integration of Quantitative and Qualitative Findings:** Mixed-methods integration occurred through convergent analysis comparing quantitative patterns with qualitative themes to identify convergence, divergence, and complementarity (Fetters et al., 2013). Joint display matrices organized findings by research question to facilitate pattern identification across data types. Divergent findings prompted re-examination of both datasets to understand apparent contradictions or to recognize that different aspects of complex phenomena were being captured by different methods (Creswell & Plano Clark, 2018).

### 3.5. Ethical Considerations

The study adhered to ethical principles outlined in the Declaration of Helsinki and Kenya's ethical research guidelines. Voluntary participation was emphasized with explicit rights to withdraw without penalty. Confidentiality was maintained through anonymization, secure data storage, and restricted access. Interviews addressing potentially sensitive topics (family financial circumstances, student academic struggles) were conducted with particular sensitivity and offers of referral to support services when distress was evident. Findings are reported in aggregate form without identifying information that could compromise participant or institutional confidentiality.

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## 4. Findings and Discussion

### 4.1. Pathway Placement Patterns and Equity Implications

Analysis of placement data across 47 schools revealed significant disparities in pathway distribution that raise substantial equity concerns. Of 2,847 students in the sample, 43.2% were placed in the STEM pathway, 38.7% in Social Sciences, and 18.1% in Arts and Sports Science. However, pathway distribution varied dramatically by socioeconomic status. Students from high-SES backgrounds were placed in STEM at rates of 61.4%, compared to 38.2% for middle-SES and just 29.7% for low-SES students ( $\chi^2 = 42.67$ ,  $df = 4$ ,  $p < 0.001$ ). Conversely, low-SES students were significantly overrepresented in Arts and Sports Science (24.3%) compared to high-SES students (9.8%).

Multinomial logistic regression modeling pathway placement while controlling for prior achievement, gender, and school characteristics confirmed that socioeconomic status independently predicted pathway assignment. Compared to high-SES students with equivalent Grade 8 assessment scores, low-SES students had 3.2 times higher odds of placement in Arts and Sports Science (OR=3.24, 95% CI [2.18, 4.82],  $p<0.001$ ) and 1.8 times higher odds of placement in Social Sciences (OR=1.79, 95% CI [1.34, 2.39],  $p<0.001$ ), with STEM as the reference category. This pattern persisted even when controlling for stated student interests, suggesting that factors beyond student aptitude or preferences influenced placement decisions.

Gender patterns revealed concerning trends particularly in STEM pathway access. While overall placement rates showed relative gender parity in Social Sciences (51% female) and Arts (54% female), STEM placement was significantly gender-skewed with only 38% female students despite girls representing 52% of the total sample ( $\chi^2=28.34$ ,  $df=2$ ,  $p<0.001$ ). Intersectional analysis revealed that low-SES girls faced compounded disadvantage, with STEM placement rates of just 21.3% compared to 67.8% for high-SES boys. These patterns align with extensive international research documenting gender bias in STEM access, particularly when intersecting with socioeconomic disadvantage (Archer et al., 2012; OECD, 2015).

Geographic disparities were equally pronounced. Urban schools placed 51.2% of students in STEM pathways compared to 37.8% in rural schools, even after controlling for prior achievement ( $\chi^2=36.92$ ,  $df=2$ ,  $p<0.001$ ). Qualitative data revealed that this disparity stemmed partially from infrastructure limitations—rural schools often lacked laboratories and equipment necessary for STEM pathway delivery—leading administrators to limit STEM enrollment regardless of student interest or aptitude. As one rural school principal explained: "We would love to offer more STEM places, but we have only one functional laboratory for 400 students. We must be realistic about what we can actually deliver." This observation underscores how structural inequalities in educational infrastructure translate directly into unequal opportunity access, perpetuating the very disadvantages that CBC ostensibly aims to address.

#### 4.2. Placement Criteria and Decision-Making Processes

Examination of actual placement processes revealed substantial divergence between official policy frameworks and implementation realities. Ministry of Education guidelines specify that placement should incorporate multiple factors: Grade 8 assessment scores (40% weight), aptitude assessments (30%), expressed student interests (20%), and career guidance consultation (10%) (Ministry of Education, 2020). However, school-level implementation showed wide variation from these prescribed procedures.

Quantitative analysis revealed that Grade 8 assessment scores showed only moderate correlation with pathway placement (Spearman's  $\rho=0.48$ ,  $p<0.001$ ), suggesting substantial influence from other factors. More concerning, the correlation between assessment scores and pathway placement was significantly stronger for high-SES students ( $\rho=0.61$ ) than for low-SES students ( $\rho=0.34$ ), indicating that socioeconomic status mediated the relationship between measured achievement and pathway assignment. This pattern suggests that placement operated more meritocratically for privileged students while being subject to greater constraint or bias for disadvantaged students.

Qualitative interviews illuminated the mechanisms producing these disparities. Teachers consistently reported that parental pressure significantly influenced placement, particularly in well-resourced schools where educated parents actively advocated for preferred pathways. "The parents who are doctors, engineers, lawyers—they come with detailed arguments about why their child must be in STEM, they bring private assessment results, they escalate to the principal," explained one teacher. "Meanwhile, the parents who are farmers or casual workers, they just accept whatever we tell them." This description vividly illustrates Lareau's (2011) concept of "concerted cultivation" whereby middle-class parents deploy cultural capital to secure advantages for their children within institutional settings.

The career guidance component of placement proved particularly problematic. Only 19 of 47 schools employed dedicated trained career counselors, with most schools assigning guidance responsibilities to teachers without relevant training or adequate time. Student interviews revealed minimal meaningful guidance: "They just told us to choose what we like, but we don't really know what these pathways lead to," reported one student. Another explained: "I wanted STEM but the teacher said I should do Social Sciences because my marks in mathematics were not so high. But no one explained what I could do with Social Sciences or if I could still become an engineer." This lack of informed guidance undermines the theoretically empowering potential of pathway choice, instead leaving students to navigate consequential decisions without adequate information or support.

Aptitude assessments, supposedly constituting 30% of placement criteria, were administered inconsistently and with questionable validity. Only 14 schools had implemented structured aptitude testing, with most employing informal

teacher assessments of uncertain reliability. One administrator candidly acknowledged: "We don't really have proper aptitude tests. Teachers just give their impressions based on classroom performance, which is basically the same as looking at exam scores." This conflation of aptitude with prior achievement is particularly problematic given research showing that standardized achievement measures can underestimate the potential of students from disadvantaged backgrounds who may lack educational resources but possess strong innate capabilities (Sternberg, 2007).

#### 4.3. Stakeholder Experiences and Perceptions

Student experiences of pathway placement revealed significant anxiety, confusion, and perceived lack of agency. Thematic analysis of student interviews identified four dominant themes: insufficient information ("I didn't really understand what each pathway means"), limited choice ("They told me which pathway I should take"), uncertain futures ("I don't know if this pathway can take me where I want to go"), and acceptance versus resistance ("Some students tried to argue but most just accepted"). Only 23% of interviewed students reported feeling that they had genuinely chosen their pathway, with the remainder describing placement as something done to them rather than a collaborative decision-making process.

Gender differences in placement experiences were notable. Girls interviewed more frequently described being steered away from STEM regardless of interest or performance: "My teacher said STEM is very hard and maybe Social Sciences would be better for me," explained one female student with strong mathematics scores. "But my brother with similar marks was encouraged to try STEM." This aligns with extensive research on gender bias in STEM education where teachers, often unconsciously, hold lower expectations for girls' mathematics and science capabilities and provide less encouragement for STEM pursuits (Gunderson et al., 2012).

Parental perspectives revealed a sharp divide by socioeconomic and education level. Educated parents from professional backgrounds expressed confidence in their understanding of pathways and their ability to influence placement: "I researched each pathway, I understand what universities require, I made sure my daughter was placed where she needs to be for medical school," stated one parent. In contrast, parents with limited education frequently expressed confusion and deference to school authority: "The teachers know better than me, I cannot argue with them," said one parent. "I just pray they have chosen correctly for my son." This differential capacity to navigate placement processes exemplifies how ostensibly neutral institutional procedures can perpetuate inequality by privileging the already-knowledgeable and assertive (Lareau & Horvat, 1999).

Teacher perspectives revealed genuine commitment to student welfare alongside significant constraints and frustrations. Teachers consistently emphasized resource limitations as primary barriers to equitable placement: "We want to place students according to their interests and abilities, but we simply don't have the facilities for everyone who qualifies for STEM. What do we tell students with good science marks when we only have space for half of them?" Resource scarcity forced rationing decisions that teachers found ethically uncomfortable, with some acknowledging that subjective judgments about student seriousness or family support influenced placement when objective criteria left borderline cases.

Teachers also expressed inadequate preparation for career guidance responsibilities: "I am a mathematics teacher, not a career counselor. I don't know enough about different careers to properly advise students. I can tell them about engineering because I know engineers, but what about careers in arts or sports science? I have no idea." This admission underscores the gap between policy aspirations for comprehensive career guidance and implementation capacity, particularly in under-resourced schools where specialized support personnel are absent (Hooley et al., 2014).

Administrative perspectives from school principals emphasized systemic challenges beyond individual school control. Principals consistently cited inadequate Ministry guidance, delayed resource allocation, and contradictory policy signals as impediments to effective implementation. "We received the CBC pathway framework very late, with little time to prepare infrastructure or train teachers. Then we receive directives to ensure equitable access, but no resources to make this possible. We are expected to work miracles," explained one principal. This implementation gap between national policy ambitions and local capacity to deliver has been a persistent feature of education reform in Kenya and other developing contexts (Vavrus et al., 2011).

#### 4.4. Academic Transitions and Support Structures

Analysis of transition experiences revealed inadequate support structures to facilitate student progression into and through differentiated pathways. Academic outcomes during the first term of Grade 9 showed concerning patterns. Students placed in Arts and Sports Science experienced significantly higher rates of course failure (28.4% failing one or more subjects) compared to STEM (14.2%) and Social Sciences (16.8%) students ( $\chi^2=47.23$ ,  $df=2$ ,  $p<0.001$ ). This

disparity persisted even when controlling for prior Grade 8 achievement, suggesting differential quality in pathway delivery rather than solely student capability differences.

Correlation between Grade 8 assessment scores and Grade 9 performance was surprisingly weak ( $r=0.43$ ,  $p<0.001$ ), raising questions about either the validity of Grade 8 assessments as predictors of senior secondary performance or the dramatic change in educational demands during transition. More troublingly, this correlation was significantly weaker for students in Arts and Sports Science pathways ( $r=0.31$ ) compared to STEM ( $r=0.52$ ) and Social Sciences ( $r=0.48$ ), suggesting that Arts pathway placement operated with less fidelity to demonstrated academic capability or that Arts pathway instruction was particularly poorly implemented.

Qualitative data illuminated specific transition challenges. Students consistently described experiencing academic shock: "Grade 9 is completely different from Grade 8. The teachers expect you to already know many things, but we were not taught this before," explained one student. Another elaborated: "In Grade 8, teachers guided us step by step. In Grade 9, they give assignments and expect us to figure out on our own." This shift toward independent learning, while developmentally appropriate and aligned with CBC's competency focus, appeared inadequately scaffolded with students receiving insufficient support to develop requisite study skills and self-regulated learning strategies.

Social adjustment challenges were pronounced, particularly for students transitioning between schools or entering pathways where they felt stigmatized. Students in Arts and Sports Science pathways frequently reported experiencing pathway hierarchy perceptions: "People think Arts is for students who failed to get STEM. Even teachers sometimes make comments that suggest Arts is a lesser option." This stigmatization phenomenon, well-documented in vocational education research internationally, can undermine student motivation and self-efficacy regardless of actual pathway quality (Arum & Shavit, 1995).

Assessment of support structures revealed minimal formalized transition programming. Only 8 of 47 schools had implemented any structured transition support, with most interventions limited to orientation days providing logistical information rather than sustained academic, social, or emotional support. No schools had implemented buddy systems, mentoring programs, or specialized transition curricula that research identifies as effective transition supports (Ellerbrock & Kiefer, 2010). Teachers acknowledged this gap but cited time and resource constraints: "We know students need more support, but we barely have time to cover the syllabus, let alone run additional transition programs."

Parental involvement in supporting transitions varied predictably by socioeconomic status. High-SES parents reported actively monitoring student adjustment, supplementing school-based instruction with tutoring, and intervening when problems emerged. Low-SES parents expressed desire to support their children but lacked knowledge of curriculum expectations or resources to provide academic assistance: "I want to help my daughter but I cannot understand what she is studying now. It is very different from what I learned." This differential capacity to provide home-based academic support creates cumulative advantage for privileged students who receive more comprehensive learning support across school and home contexts (Cheadle, 2008).

#### **4.5. Infrastructure and Resource Adequacy**

Quantitative assessment of infrastructure revealed severe inadequacies, particularly for technical pathway delivery. On a standardized infrastructure adequacy scale (0-100), schools averaged just 47.3 ( $SD=18.6$ ), indicating less than half of necessary facilities and equipment were available. Rural schools scored significantly lower ( $M=38.2$ ) than urban schools ( $M=58.7$ ) ( $t(45)=4.83$ ,  $p<0.001$ ). Specific deficits included: only 34% of schools had functional science laboratories meeting minimum standards, 18% had sports facilities adequate for sports science pathway delivery, 12% had arts studios or performance spaces, and 8% had workshops equipped for technology pathway instruction.

These infrastructure deficits directly constrained pathway offerings and quality. Schools with inadequate laboratories rationed STEM pathway places despite student demand, while schools lacking arts facilities offered Arts pathways in name only, delivering theoretical instruction without practical skill development opportunities. "We teach sports science without proper sports fields or equipment. We teach visual arts without art supplies. It is teaching in theory only," lamented one teacher. This situation exemplifies how policy ambitions unmatched by resource allocation produce implementation failure that undermines reform objectives (Fullan, 2007).

Human resource capacity proved equally problematic. Only 41% of teachers delivering CBC senior secondary content had received any CBC-specific training, with most relying on 8-4-4-era pedagogical approaches despite CBC's emphasis on active, competency-based instruction. Teacher-student ratios averaged 1:48 in public schools compared to 1:22 in

private schools ( $t(45)=6.34$ ,  $p<0.001$ ), making individualized attention and formative assessment—both central to competency-based approaches—nearly impossible in resource-constrained settings. Teacher qualifications showed concerning gaps particularly for specialized pathway content, with 32% of teachers delivering pathway-specific courses lacking subject-specific qualifications beyond diploma level.

Digital infrastructure, increasingly essential for contemporary competency-based education, remained severely inadequate. Only 23% of schools had computer laboratories with sufficient functional computers for class-sized groups. Internet connectivity was available in just 38% of schools and reliable in even fewer. This digital divide severely constrains CBC's potential to leverage educational technology for personalized learning and limits student development of digital literacy competencies increasingly required in modern labor markets (Warschauer & Matuchniak, 2010).

#### 4.6. Comparison with International Pathway Systems

Kenya's CBC pathway implementation experiences resonate with international research on tracked systems while exhibiting context-specific features. The socioeconomic stratification observed in Kenyan pathway placement closely parallels patterns documented in German, Dutch, and other European tracked systems where family background substantially influences track assignment even controlling for achievement (Dustmann et al., 2017; Van de Werfhorst & Mijs, 2010). However, Kenya's pathway differentiation occurs at a later age (Grade 9, approximately age 14-15) than many European systems, potentially mitigating some early-tracking disadvantages that arise when developmental differences are conflated with capability differences (Brunello & Checchi, 2007).

The infrastructure challenges undermining Kenyan pathway implementation reflect broader developing country constraints on education reform implementation. Rwanda's CBC experience provides particularly relevant parallels, with similar gaps between policy ambitions and implementation capacity, particularly regarding teacher preparation, assessment transformation, and resource adequacy (Uworwabayeho et al., 2019). These parallel challenges suggest systemic constraints in Sub-Saharan African educational contexts that require explicit attention in reform design and resourcing, rather than assuming implementation capacity exists to deliver policy intentions (Altinyelken, 2010).

Kenya's pathway system exhibits less rigidity than some international comparatives, with policy documents emphasizing pathway permeability through common core subjects and theoretically allowing pathway changes. However, early evidence suggests that practical barriers to pathway mobility—including timetabling constraints, subject prerequisite gaps, and administrative resistance—may produce de facto rigidity despite formal flexibility provisions. This pattern mirrors research on comprehensive high schools in the United States that nominally avoid tracking but develop internal differentiation systems with comparable stratification effects (Lucas, 2001; Kelly, 2009).

The stigmatization of non-academic pathways observed in Kenya reflects a globally pervasive phenomenon where vocational or technical education is perceived as inferior to academic education despite policy rhetoric valuing diverse talents (Arum & Shavit, 1995). Combating such perceptions requires not merely curriculum reform but broader cultural transformation in how societies value different forms of knowledge and skill—a challenge that has proven intractable in many contexts regardless of resource levels (Gamoran, 2010). Kenya's challenge is compounded by labor market realities where university credentials command substantial wage premiums and technical qualifications offer less certain employment prospects, making rational calculation align with academic pathway preference even absent cultural prejudice (Oketch et al., 2014).

#### 4.7. Early Indicators of Differential Pathway Outcomes

Analysis of early academic outcomes raises concerns about pathway quality differentials. Student performance trajectories diverged significantly across pathways during the first year of senior secondary school. Controlling for Grade 8 assessment scores, students in STEM pathways gained an average of 4.2 percentage points on standardized assessments between Grade 8 and Grade 9 first term, while Social Sciences students gained 2.1 percentage points and Arts students declined by 1.3 percentage points ( $F(2,2844)=37.62$ ,  $p<0.001$ ). These differential trajectories suggest unequal learning opportunity quality across pathways rather than solely reflecting student capability differences at placement.

Dropout and transfer patterns provided additional concerning signals. While overall dropout rates remained low (2.3%) during the first term, Arts pathway students exhibited significantly higher dropout rates (4.7%) compared to STEM (1.1%) and Social Sciences (2.0%) ( $\chi^2=18.34$ ,  $df=2$ ,  $p<0.001$ ). Transfer requests to move from Arts to other pathways (8.7% of Arts students) exceeded requests to move into Arts (1.2% of students in other pathways), suggesting dissatisfaction with Arts pathway placement or quality.

Student engagement metrics from teacher reports showed pathway differences. Teachers rated Arts pathway students as less academically engaged ( $M=5.2$  on 10-point scale) compared to STEM ( $M=7.1$ ) and Social Sciences ( $M=6.8$ ) students ( $F(2,2844)=42.18, p<0.001$ ). While potentially reflecting genuine student motivation differences, qualitative data suggest that stigmatization and perceived limited opportunity may contribute to disengagement. Students who perceive their pathway as a "dumping ground" understandably exhibit reduced motivation even if the curriculum itself holds potential value (Oakes, 2005).

Teacher quality allocation across pathways revealed concerning patterns. The most qualified and experienced teachers were disproportionately assigned to STEM pathways, while Arts pathways received less experienced teachers or those teaching outside their specialization. This teacher quality stratification, documented in tracked systems internationally, produces self-fulfilling prophecies where pathway hierarchy in resourcing and staffing generates outcome disparities that are then attributed to student capability rather than unequal opportunity (Gamoran, 2009).

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## 5. Conclusion

Kenya's implementation of CBC pathway differentiation at the senior secondary level reveals profound tensions between reform aspirations and implementation realities. While the policy framework articulates compelling objectives—accommodating diverse learner talents, providing multiple routes to success, reducing examination pressure—actual implementation has produced troubling patterns of inequity, inadequate support, and resource deficits that threaten to undermine reform objectives. Socioeconomic stratification in pathway placement, wherein disadvantaged students are systematically channeled toward lower-status pathways regardless of aptitude, risks entrenching rather than disrupting educational inequality. The weak correlation between placement criteria and subsequent academic performance suggests flawed placement mechanisms that fail to optimize student-pathway matching. Inadequate transition supports leave students navigating consequential educational shifts without sufficient guidance or assistance, while severe infrastructure deficits prevent competency-based curriculum delivery particularly in technical pathways. These implementation challenges are not merely teething problems of a new system but reflect systemic gaps in policy design, resource allocation, teacher preparation, and institutional capacity that require urgent, comprehensive intervention to realize CBC's transformative potential.

### *Recommendations*

- **Policy-Level Interventions**

The Ministry of Education should establish rigorous, transparent placement criteria with clear guidance preventing socioeconomic or gender bias, including mandatory aptitude assessments developed and validated by assessment specialists, structured interest inventories, and parental consultation protocols ensuring genuine family engagement. A national career guidance framework should be implemented with comprehensive training for teacher-counselors, development of age-appropriate career information resources, and establishment of guidance counselor positions in all secondary schools. Pathway permeability must be strengthened through common core curricula maintaining knowledge continuity across pathways, simplified transfer procedures with clear criteria, and bridging courses facilitating pathway mobility. Substantial infrastructure investment is imperative, requiring dedicated CBC implementation funds for laboratories, workshops, sports facilities, and digital infrastructure with prioritization of under-resourced schools to reduce inequity.

- **School-Level Recommendations**

Schools should implement comprehensive transition programs including summer bridge sessions, peer mentoring, study skills instruction, and sustained check-ins during the first term. Pathway stigmatization must be actively combated through celebrating diverse pathway achievements, ensuring equal resource allocation and teacher quality across pathways, and community education regarding pathway value. Parent engagement initiatives should include workshops explaining pathways and placement processes, translated materials for non-English-speaking families, and structured consultation ensuring genuine participation in placement decisions. Professional development for teachers should emphasize competency-based pedagogy, formative assessment techniques, career guidance skills, and understanding adolescent development and transition needs.

- **Research and Monitoring Priorities**

Longitudinal tracking of CBC cohorts through senior secondary school, university/training admission, and labor market outcomes is essential to assess pathway effectiveness and long-term equity impacts. Rigorous evaluation of placement

mechanisms examining validity, reliability, and bias in assessments, decision-making processes, and stakeholder experiences will inform continuous improvement. Comparative implementation research across counties and school types can identify success factors and barriers, generating evidence-based implementation guidance. Finally, international comparative studies examining Kenya's CBC experience relative to other nations' pathway systems can yield transferable lessons while contextualizing Kenya's unique challenges and opportunities within global education reform discourse.

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## Compliance with ethical standards

### *Disclosure of conflict of interest*

No conflict of interest to be disclosed.

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