

A Comparative Study of School Infrastructure and Competency-Based Curriculum Implementation in Public and Private Primary Schools, Vihiga County, Kenya

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Abstract

This study provides a comparative analysis of school infrastructure and its impact on the implementation of the Competency-Based Curriculum (CBC) in public and private primary schools within Vihiga County, Kenya. The CBC was introduced to replace the previous 8.4.4

education system. The research specifically aimed to assess the influence of school infrastructure on CBC execution across the two school types. The investigation was guided by Open Systems Theory and employed a mixed-methods research design. The target population included 408 head teachers, 4,392 teachers, 15 curriculum support officers, and 5 Sub-County Education Officers. Using stratified, simple random, and purposive sampling techniques, a sample of 81 head teachers, 366 teachers, 5 curriculum support officers, and 2 Sub-County Education Officers was selected. Data collection instruments comprised questionnaires, interview guides, and observation guides. Quantitative data were analyzed using descriptive statistics (frequencies and percentages), while qualitative data were analyzed thematically. A t-test was used to examine the relationship between school infrastructure and CBC implementation. The findings revealed that public primary schools lacked adequate classrooms, laboratories, workshops, internet connectivity, and science and ICT devices for effective CBC delivery. In contrast, private primary schools were found to have sufficient classrooms, reliable electricity, internet connectivity, and necessary science and ICT devices. However, both public and private schools demonstrated inadequate sports and games facilities. The t-test results indicated a statistically significant relationship between school infrastructure and CBC implementation for both school types (p-value = 0.000, < 0.05 significance level).

Keywords: Competency-Based Curriculum, Infrastructure, T-test, ICT.

1. Introduction

Education is universally recognized as the bedrock of national progress, serving as the primary engine for a country's social cohesion, economic advancement, and political stability (Republic of Kenya, 2012). Beyond imparting knowledge, its fundamental role is to empower successive generations with the adaptive capabilities, critical thinking, and problem-solving skills required to navigate and solve complex, evolving global challenges. This imperative has catalyzed a global re-evaluation of educational paradigms. As Kajuju, Nduku, and Wambiya (2024) contend, the education system of the 21st century must undergo a fundamental realignment. It must transition from a model focused on content memorization to one explicitly designed to cultivate the specific skills, knowledge bases, and attitudes such as collaboration, innovation, and digital literacy that are in high demand within the contemporary global labour market.

It is within this context of necessary transformation that Kenya's landmark curriculum reform must be understood. For over three decades, the country's education system was governed by the 8.4.4 structure, which itself replaced an earlier model. In 2017, Kenya initiated a decisive shift to the Competency Based Curriculum (CBC), symbolized by the new 2-6-3-3-3 framework (2 years pre-primary, 6 primary, 3 junior secondary, 3 senior secondary, 3 tertiary). This was not a mere administrative change but a profound philosophical overhaul. The transition aimed to dismantle an academically-oriented system, widely criticized for its rigidity, and replace it with a learner-centered model dedicated to developing demonstrable skill competencies. As Wanjohi (2017) notes, the government's explicit intent was to foster the development of skilled, holistic, and adaptable individuals whose potential aligns with the dynamics of modern economies. Therefore, the core objective of the CBC is to systematically identify and nurture each learner's unique talents and aptitudes, thereby transforming education into a direct pipeline for meaningful socio-economic contribution.s

The rationale for this disruptive change is well-documented. An authoritative assessment by the Kenya Institute of Curriculum Development (2017) concluded that the outgoing 8.4.4 system was fundamentally misaligned with national needs. Its overwhelming emphasis on summative, high-stakes examination scores came at a severe cost: the neglect of learners' individual competencies, aptitudes, and interests. This mismatch yielded detrimental outcomes, including high dropout rates among students who could not thrive in a purely academic contest, and the production of graduates who, despite possessing certificates, often lacked the practical and innovative skills required by employers and society.

The CBC proposes a corrective pedagogy centered on continuous formative assessment. This approach involves ongoing, interactive evaluations designed to monitor student learning and provide feedback for improvement throughout the learning process. It empowers teachers to identify individual strengths and weaknesses early, allowing them to tailor instruction and guide learners along personalized pathways from the earliest years. However, the effective implementation of this ideal is confronted by formidable systemic barriers. Scholars consistently identify a constellation of impediments, including severe physical and logistical constraints such as overcrowded classrooms and inadequate infrastructure; chronic resource

limitations encompassing financial shortages, insufficient instructional materials, and high pupil-teacher ratios; and critical human capacity gaps, notably insufficient teacher professional development for the new pedagogical approaches (Jebii, 2022; Mavale, 2021; Inyega et al., 2021). Thus, the successful transition from the old system to the new depends not only on sound curriculum design but also on the nation's capacity to address these deep-rooted implementation challenges.

1.1 Statement of the Problem

In Vihiga County, the introduction of the CBC in both public and private primary schools faces significant obstacles due to insufficient infrastructure. Despite the CBC's focus on learner-centered, hands-on activities, most schools grapple with challenges including a lack of ICT integration, inadequate classrooms, laboratories, workshops, playfields, unreliable electricity, untrained ICT teachers, high enrolment, and scarce equipment. Successful CBC implementation necessitates adequate infrastructure. The disparity in infrastructural adequacy between public and private schools necessitated this comparative investigation.

1.2 Research Objective

To investigate the influence of infrastructure on the implementation of the Competency-Based Curriculum in private and public primary schools in Vihiga County, Kenya.

1.3 Research Hypothesis

There is no statistically significant difference between public and private schools concerning the adequacy of school infrastructure and the implementation of the Competency-Based Curriculum.

2. Literature Review

The existing body of research consistently identifies school infrastructure as a critical determinant in the successful rollout of Competency-Based Curricula (CBC) globally, with pronounced disparities between public and private education sectors.

Studies across different national contexts converge on similar infrastructural barriers. Kubai's (2023) research in Nairobi County, Kenya, specifically pinpointed inadequate ICT infrastructure such as computers, internet connectivity, and software as a primary obstacle. This finding is not isolated. In Nigeria, Akpan and Salihu (2023) expanded the scope, highlighting that insufficient physical facilities extend beyond ICT to include core learning spaces like classrooms, laboratories, and recreational areas. Their work underscores that the CBC's emphasis on hands-on, practical activities is fundamentally compromised without these foundational resources. Both studies implicitly point to a common root cause: inadequate funding and resource allocation, particularly within public education systems, which stifles the acquisition and maintenance of necessary infrastructure.

The theme of funding is further elaborated in related literature. Mulenga and Kabombwe (2019), focusing on Zambia, emphasized that ICT infrastructure is not merely supplemental

but critical for core CBC functions like e-learning and e-assessment, which enable personalized and continuous evaluation. Echoing this in the Kenyan context, Murithi and Yoo (2021) explicitly identified limited financial allocation as the key constraint. This scarcity creates a dual problem: it restricts the procurement of hardware and software while simultaneously limiting investments in the professional development of teachers, who require training to effectively utilize these technologies. Thus, financial limitations create a cycle of deficiency affecting both physical assets and human capital.

The Public-Private Infrastructure Divide: A salient theme in the literature is the stark contrast between school types. Amunga, Were, and Ashioya (2020) directly addressed this disparity, noting that private schools in Kenya generally possess superior infrastructure. They are more likely to have adequate classrooms, specialized rooms (e.g., for music, home science, and labs), and modern technological devices. In contrast, public schools frequently grapple with a lack of these essential facilities. This divide is exacerbated in public schools by associated systemic challenges such as high student enrollment, leading to overcrowding, and chronic understaffing. The learner-centered, activity-based pedagogy of the CBC is severely hindered in such environments, as the necessary space, tools, and individualized attention are absent.

The transformative potential of ICT within CBC is widely acknowledged. Mpisili (2022) argued that ICT inclusion is vital for shifting education from a theory-heavy, academic model to a practical-oriented system that develops 21st-century skills. However, acquiring hardware is only the first step. Murithi and Yoo (2021) crucially identified a parallel and pervasive challenge: a widespread lack of digitally skilled teachers. This impediment affects both private and public schools, suggesting that even where infrastructure exists, its effective integration into teaching and learning is not guaranteed. Therefore, the literature presents a two-fold challenge: bridging the physical digital divide in resources and addressing the human capacity gap in digital pedagogical skills.

In summary, the literature establishes a clear narrative: Effective CBC implementation is highly dependent on adequate physical and digital infrastructure. A persistent funding gap, particularly acute in public schools, creates a significant resource disparity between public and private sectors, disadvantaging public school learners. Furthermore, success requires moving beyond mere provision of equipment to include comprehensive teacher training. The existing research thus frames infrastructure not as a standalone issue, but as an interconnected component of funding, equity, and teacher competency, all of which must be addressed to realize the goals of competency-based education.

3. Research Methodology

This study was conducted in Vihiga County, Kenya, selected purposively due to the unknown status of infrastructure adequacy for CBC implementation. A descriptive research design utilizing mixed methods was adopted. The target population comprised 408 head teachers, 4,567 teachers, 15 curriculum support officers, and 5 Sub-County Education Officers. Stratified and simple random sampling were used to select 81 head teachers (77 public, 4 private) and 368 teachers (354 public, 14 private). Purposive sampling selected 5 curriculum support officers and 2 Sub-County Education Officers. Data were gathered via questionnaires,

interview guides, and observation guides. Quantitative data were analyzed using descriptive statistics (frequencies, percentages) and inferential statistics (t-test). Qualitative data were analyzed thematically.

4. Results and Discussions

Data from Likert-scale responses (1=Strongly Disagree to 5=Strongly Agree) were analyzed using frequencies and percentages.

Table 1. Infrastructural Provision and Competency-Based Curriculum

Infrastructure and CBC	Type of School	Respondents	SD	D	N	A	SA
Availability of Internet Connection	Public	H/T's	23 (29.9%)	24 (31.2%)	10 (12.9%)	9 (11.7%)	11 (14.3%)
		TR's	77 (30.8%)	143 (57.2%)	2 (0.8%)	17 (6.8%)	11 (4.4%)
	Private	H/T's	-	-	-	3 (75.0%)	1 (25.0%)
		TR's	-	-	1 (7.1%)	9 (64.3%)	4 (28.6%)
Adequacy of Classrooms, Libraries, Workshops, Labs	Public	H/T's	24 (31.2%)	43 (55.8%)	3 (3.9%)	6 (7.8%)	1 (1.3%)
		TR's	86 (34.4%)	133 (53.2%)	9 (3.6%)	14 (5.6%)	8 (3.2%)
	Private	H/T's	-	-	-	3 (75.0%)	1 (25.0%)
		TR's	1 (7.1%)	2 (14.3%)	2 (14.3%)	6 (42.9%)	3 (21.4%)
Availability of Electricity Supply	Public	H/T's	7 (9.1%)	14 (18.2%)	5 (6.5%)	29 (37.7%)	22 (28.6%)
		TR's	13 (5.2%)	20 (8.0%)	18 (7.2%)	123 (49.2%)	76 (30.4%)
	Private	H/T's	-	-	-	2 (50.0%)	2 (50.0%)
		TR's	-	-	-	8 (57.1%)	6 (42.9%)
Adequacy of Lab and ICT Equipment	Public	H/T's	19 (24.7%)	26 (33.8%)	5 (6.5%)	13 (16.9%)	14 (18.2%)
		TR's	121 (48.4%)	89 (35.6%)	13 (5.2%)	24 (9.6%)	3 (1.2%)
	Private	H/T's	-	1 (25.0%)	1 (25.0%)	2 (50.0%)	-
		TR's	1 (7.1%)	2 (14.3%)	3 (21.4%)	6 (42.9%)	2 (14.3%)
Adequacy of Sports and Games Facilities	Public	H/T's	20 (25.9%)	25 (32.5%)	3 (3.9%)	19 (24.7%)	10 (12.9%)
		TR's	61 (24.4%)	78 (31.2%)	21 (8.4%)	59 (23.6%)	31 (12.4%)
	Private	H/T's	2 (50.0%)	2 (50.0%)	-	-	-
		TR's	6 (42.9%)	8 (57.1%)	-	-	-

The data reveals a fundamental disparity in the basic physical learning environment between public and private schools. A strong majority of public-school educators over half of both head teachers (55.8%) and teachers (53.2%) explicitly stated that their schools lacked adequate classrooms, laboratories, libraries, and workshops. This overwhelming consensus points to a systemic deficit. Direct observations corroborated this, describing overcrowded and dilapidated classrooms with insufficient furniture, which physically impedes the movement and interactive, hands-on learning central to the CBC pedagogy. In stark contrast,

a clear majority of private school head teachers (75.0%) and a plurality of teachers (42.9%) affirmed the adequacy of their core facilities. This suggests that private schools generally provide the foundational spaces necessary for CBC activities.

Table 2. Relationship between CBC and learning infrastructure

Table 2. Relationship between learning infrastructure and CBC

One-Sample Test						
Test value = 0						
				95% Confidence Interval of the Difference		
	t	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
Public	37.17	326	.000	1.9052	1.804	2.006
Private	14.00	17	.000	3.7222	3.161	4.282

The statistically significant relationship ($p = 0.000$) between this infrastructure and CBC implementation underscores that the quality of the physical learning environment is not merely a background factor but a direct determinant of curricular success. The disparity implies that private schools are structurally better positioned to offer the individual learner attention and practical activity spaces that the CBC demands, a finding that aligns with research by Akpan and Salihu (2023) on the critical role of physical facilities.

Table 3. Relationship between implementation of CBC and sports facilities Table 3: Relationship between sporting facilities and implementation of CBC

One-Sample Test						
Test Value = 0						
				95% Confidence Interval of the Difference		
	t	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
Public	34.70	326	.000	2.6789	2.527	2.830
Private	12.90	17	.000	1.5555	1.301	1.809

Findings on Sports and Games Facilities emerged as a notable common challenge, transcending the public-private divide. A significant portion of respondents in both sectors reported inadequacies: approximately one-third in public schools and over half in private schools. This indicates that co-curricular infrastructure is a widespread weakness.

Observations provided critical context: while some public schools had playfields but lacked equipment, many private schools (often located in constrained urban plots) lacked dedicated sports grounds altogether. Furthermore, the study highlighted a parallel deficit in teacher expertise for co-curricular instruction, suggesting that even where facilities exist, they may be underutilized. The significant t-test result ($p = 0.000$) confirms that the lack of sports and games facilities constitutes a tangible barrier to the holistic development goal of the CBC, which aims to nurture talents beyond academics, as emphasized by Ngeno et al. (2021).

Table 4. Relationship between CBC Implementation and availability of electricity

One-Sample Test						
Test Value = 0						
		95% Confidence Interval of the Difference				
	t	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
Public	60.54	326	.000	3.8379	3.713	3.962
Private	36.87	17	.000	4.4444	4.190	4.698
Dependent	75.15	344	.000	3.8463	3.745	3.947

Electricity availability presented a rare point of relative parity and progress. Most respondents across both school types acknowledged its presence, with private schools reporting slightly higher confidence levels. This finding is crucial as reliable power is a non-negotiable prerequisite for digital learning and the use of any modern educational technology. The strong statistical relationship ($p = 0.000$) validates the centrality of electricity to modern curriculum implementation. This result aligns with Mulenga and Kabombwe (2019), who identified electricity as foundational for e-learning. It does, however, contrast with studies from other contexts that highlight persistent power deficits, suggesting that grid connectivity in Vihiga County's schools may be one of the more addressed infrastructural elements, even as the devices to plug into it remain scarce.

Table 5. Relationship between CBC and internet connectivity

One-Sample Test						
Test Value = 0						
					95% Confidence Interval of the Difference	
	t	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
Public internet connectivity	33.88	326	.000	2.0825	1.961	2.203
Private internet connectivity	32.67	17	.000	4.2222	3.949	4.494

On Internet Connectivity, the public-private divide re-emerges sharply. A majority of public-school teachers (57.2%) and a large plurality of head teachers (31.2%) reported a lack of internet, whereas strong majorities in private schools confirmed its availability. This is more than a simple gap; it represents a digital chasm. Interviews revealed that for public schools, cost, maintenance, security, and a lack of technical support create a prohibitive barrier. This absence fundamentally cripples the potential for digital literacy, online research, and ICT-integrated pedagogy mandated by the CBC. The significant statistical relationship ($p = 0.000$) underscores that internet connectivity is a key differentiator in a school's capacity to fully deliver the 21st-century competencies outlined by the curriculum, directly supporting Mpisili's (2022) advocacy for ICT inclusion.

The deficit in the tools and devices for practical science and digital learning is severe, particularly in public schools. Nearly half of public-school teachers (48.4% strongly disagreeing) painted a picture of acute scarcity. In private schools, perceptions were more varied but still pointed to limitations; while 50% of head teachers agreed on adequacy, teacher responses were mixed, indicating that equipment may be present but is possibly insufficient in quantity or quality for optimal CBC implementation. Observations confirmed that most public schools have negligible ICT and science apparatus, while private schools possess only marginal infrastructure.

Relationships between CBC and equipment connectivity

One-Sample Test

Test Value = 0

		95% Confidence Interval of the Difference				
	t	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
Public	30.492	326	.000	1.97859	1.8509	2.1062
Private	11.524	13	.000	3.07143	2.4956	3.6472

The significant t-test result ($p = 0.000$) confirms that the availability of this equipment is a strong factor influencing CBC outcomes. This finding concurs with Amunga et al. (2020), highlighting the relative advantage of private schools while revealing that neither sector is fully equipped to the standard required for a robust, technology- and experiment-driven curriculum like the CBC.

5. Conclusions and Recommendations

The study concludes that most public primary schools in Vihiga County lack adequate infrastructure classrooms, laboratories, workshops, playfields, equipment, and internet for effective CBC facilitation. Private schools, however, generally possess sufficient infrastructure, including internet, equipment, reliable power, and adequate classrooms. Sports and games facilities were found to be inadequate in both school types. Inferential statistics confirmed a significant relationship between school infrastructure and CBC implementation in both public and private schools.

The study recommends that the Government of Kenya, through the Ministry of Education and relevant stakeholders, should ensure adequate learning infrastructure and supportive policies to facilitate the effective implementation of the Competency-Based Curriculum in all schools.

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