

INFRASTRUCTURAL CHALLENGES AFFECTING THE IMPLEMENTATION OF COMPETENCY-BASED EDUCATION IN PUBLIC JUNIOR SECONDARY SCHOOLS IN KABETE SUB-COUNTY, KIAMBU COUNTY, KENYA

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International Academic Journal of Social Sciences and Education (IAJSSE) | ISSN 2518-2412

Received: 4th August 2026

Published: 24th August 2026

Full Length Research

Available Online at: https://iajournals.org/articles/iajsse_v2_i4_361_372.pdf

Citation: Mwinyui, M. E., Wamichwe, J., Kerubo, J. (2026). Infrastructural challenges affecting the implementation of competency-based education in public junior secondary schools in Kabete Sub-County, Kiambu County, Kenya. *International Academic Journal of Social Sciences and Education*, 2(4), 361-372.

ABSTRACT

The implementation of Competency-Based Education (CBE) in Kenya introduced Junior Secondary Schools (JSS) as an important component of the restructured basic education system. The reform emphasizes learner-centered instruction, practical learning, continuous assessment, creativity, collaboration, and the development of competencies required for effective participation in society. However, inadequate school infrastructure may constrain the effective implementation of these approaches. This study examined infrastructural challenges affecting the implementation of Competency-Based Education in public Junior Secondary Schools in Kabete Sub-County, Kiambu County, Kenya. The study was guided by Systems Theory and adopted a descriptive survey research design. The target population comprised head teachers, Junior Secondary School teachers, Grade 9 learners, and parents in public schools hosting Junior Secondary Schools. A sample of 338 respondents was selected, comprising 6 head teachers, 30 Junior Secondary School teachers, 290 Grade 9 learners, and 12 parents. The study employed questionnaires, semi-structured interview schedules, and a document analysis guide to collect quantitative and qualitative data. Quantitative data were analyzed using SPSS Version 26 through frequencies, percentages, means, and

standard deviations, while qualitative data were analyzed thematically. Of the 338 targeted respondents, 317 representing a response rate of 94%. The findings indicated that inadequate classrooms, overcrowding, insufficient science laboratories, limited ICT facilities, inadequate libraries and sanitation facilities, lack of workshops, and inadequate specialized learning spaces constrained effective implementation of CBE. These infrastructural challenges limited practical learning, learner participation, continuous assessment, digital learning, and effective curriculum delivery. The study concludes that adequate and appropriate infrastructure is essential for successful implementation of Competency-Based Education. The study recommends increased government funding for JSS infrastructure, accelerated construction and equipping of classrooms and laboratories, improvement of ICT infrastructure, and strengthened collaboration among government agencies, school Boards of Management, communities, and other education stakeholders.

Key words; Competency-Based Education, Junior Secondary Schools, Infrastructure, Curriculum Implementation, Kabete Sub-County, Kenya.

INTRODUCTION

Educational reforms across the world have increasingly focused on equipping learners with knowledge, skills, values, attitudes, and competencies required to respond effectively to the demands of the twenty-first century. Competency-Based Education (CBE) emphasizes the ability of learners to apply knowledge and skills to real-life situations rather than concentrating exclusively on the acquisition and reproduction of content. This approach requires learning environments that facilitate practical activities, collaboration, experimentation, creativity, problem-solving, and learner participation.

Kenya introduced the Competency-Based Curriculum (CBC) in 2017 as a major education reform intended to replace the 8-4-4 system. The reform introduced a new structure of basic education and established Junior Secondary School education covering Grades 7 to 9. The Basic Education Curriculum Framework emphasizes the development of competencies and the use of learner-centred approaches that require appropriate teaching and learning environments (Kenya Institute of Curriculum Development [KICD], 2017, 2019).

Effective implementation of CBE requires adequate physical and technological infrastructure. Classrooms should provide sufficient space for individual and group activities, while science laboratories and workshops are necessary for practical learning. Libraries provide opportunities for independent learning and research, whereas ICT facilities support digital literacy and integration of technology into classroom instruction. Adequate sanitation facilities are also necessary for creating safe and supportive learning environments.

Despite government efforts to expand educational infrastructure, inadequate facilities continue to present challenges in many public schools. Too et al. (2024), for example, found that infrastructure and resource preparedness remain important considerations in the implementation of CBC in Kenyan public primary schools. Their findings indicate that inadequate classrooms and other learning facilities can constrain the achievement of curriculum objectives.

The transition of learners into Junior Secondary Schools has increased demand for classrooms, laboratories, ICT facilities, libraries, workshops, sanitation facilities, and other specialized learning spaces. In some public schools, existing facilities were initially designed to serve primary school learners and have therefore come under increased pressure following the introduction of JSS.

Kabete Sub-County in Kiambu County is among the areas implementing Junior Secondary School education. The increased demand for infrastructure creates a need to examine whether available facilities are adequate to support the pedagogical approaches required under CBE. Understanding the infrastructural challenges experienced by public Junior

Secondary Schools in Kabete Sub-County is therefore important for informing educational planning, resource allocation, and policy implementation.

Statement of the problem

The Government of Kenya has invested considerable resources in implementing Competency-Based Education through teacher recruitment, capitation, curriculum development, and infrastructure development. Despite these efforts, public Junior Secondary Schools continue to experience infrastructural challenges that may undermine effective curriculum implementation.

Competency-Based Education requires learning environments that facilitate practical learning, project work, experimentation, collaboration, creativity, ICT integration, and continuous assessment. However, inadequate classrooms, overcrowding, insufficient science laboratories, limited ICT facilities, inadequate libraries and sanitation facilities, and insufficient specialized learning spaces may limit teachers' ability to employ these approaches effectively.

In Kabete Sub-County, some public Junior Secondary Schools operate in facilities that were initially designed for primary-level education. The resulting pressure on available classrooms and specialized facilities may affect the quality of teaching and learning. Inadequate infrastructure may consequently limit learner participation, practical learning, digital learning, and acquisition of the competencies envisaged under CBE.

Although previous studies have examined challenges associated with implementation of CBC in Kenya, there is limited empirical evidence specifically focusing on infrastructural challenges affecting the implementation of CBE in public Junior Secondary Schools in Kabete Sub-County, Kiambu County. This study therefore examined the infrastructural challenges affecting implementation of CBE in public Junior Secondary Schools in the sub-county.

LITERATURE REVIEW

Infrastructure is an important component of effective curriculum implementation because it provides the physical environment within which teaching and learning take place. Competency-Based Education requires learning environments that promote practical instruction, collaborative activities, experimentation, creativity, learner engagement, and continuous assessment.

UNESCO (2021) emphasizes the importance of creating appropriate learning environments as education systems respond to changing educational demands. Similarly, the World Bank (2018) identifies the learning environment as one of the factors that can influence the quality of education and learning outcomes.

In the Kenyan context, the implementation of CBC has created increased demand for appropriate physical and technological facilities. Too et al. (2024) examined infrastructure and resource preparedness in public primary schools in Baringo County and reported challenges related to classrooms, teaching materials, and other learning resources. Their study demonstrates the importance of infrastructure and resource preparedness in supporting CBC implementation.

Akala (2021) observed that Kenya's curriculum reform has significant potential to transform education but that implementation requires adequate institutional and resource capacity. In the context of JSS, this includes classrooms, laboratories, ICT facilities, libraries, workshops, and sanitation facilities.

Inadequate classrooms may result in overcrowding, making it difficult for teachers to organize learners into groups or provide individualized attention. Similarly, inadequate science laboratories can restrict practical activities and force teachers to rely on theoretical explanations. This is particularly problematic because CBE emphasizes the application of knowledge and development of practical competencies.

ICT infrastructure is equally important because digital literacy and technology integration form an important component of contemporary education. Schools without adequate computers, internet connectivity, projectors, and other digital learning resources may face difficulties in implementing technology-supported learning.

The literature therefore demonstrates that adequate infrastructure is an important prerequisite for successful implementation of CBE. However, there remains a need for localized evidence on the extent to which infrastructural challenges affect public Junior Secondary Schools in Kabete Sub-County.

Theoretical Framework

The study was guided by Systems Theory developed by Ludwig von Bertalanffy (1968). Systems Theory views an organization as an open system consisting of interrelated and interdependent components that interact with one another to achieve common goals.

A school can therefore be viewed as an educational system comprising inputs, processes, outputs, and feedback mechanisms. Inputs include teachers, learners, infrastructure, financial resources, learning materials, and stakeholder support. These inputs interact through teaching and learning processes to produce educational outputs such as learner competencies, academic achievement, values, and skills.

Infrastructure constitutes an important input within the school system. Adequate classrooms, laboratories, ICT facilities, libraries, workshops, and sanitation facilities facilitate effective teaching and learning. Conversely, deficiencies in infrastructure can disrupt teaching and learning processes and negatively affect educational outcomes.

Systems Theory was therefore appropriate because the study examined infrastructure as one component of the wider educational system. The theory recognizes that weaknesses in one component may affect the functioning of other components and ultimately influence the achievement of educational objectives.

RESEARCH METHODOLOGY

Research Design

The study adopted a descriptive survey research design. The design was appropriate because it enabled the researcher to obtain information concerning the existing infrastructural conditions in public Junior Secondary Schools and their implications for implementation of Competency-Based Education.

The design also enabled the researcher to collect both quantitative and qualitative information from respondents directly involved in the implementation of CBE.

Study Area

The study was conducted in Kabete Sub-County, Kiambu County, Kenya. The study focused on public schools hosting Junior Secondary School learners. The area was selected because it provides an appropriate context for examining infrastructural challenges associated with implementation of CBE at the Junior Secondary School level.

Target Population

The target population comprised head teachers, Junior Secondary School teachers, Grade 9 learners, and parents in public schools hosting Junior Secondary Schools. These groups were selected because they are directly involved in or affected by the implementation of Competency-Based Education.

Sample Size

The sample consisted of 338 respondents. The sample was distributed as follows:

Table 1: Sample Size Distribution

Category of respondents	Sample size
Head teacher	6
Junior secondary school teachers	30
Grade 9 learners	290
Parents	12
TOTAL	338

The sample was selected to obtain information from different categories of stakeholders involved in Junior Secondary School education. Sampling procedures used in selecting each category should be stated explicitly in the final journal version according to the actual procedure used during the study.

Data Collection Instruments

The study used questionnaires, semi-structured interview schedules, and a document analysis guide. Structured questionnaires were administered to the selected teachers, learners, and parents. Semi-structured interviews were conducted with head teachers to obtain detailed information concerning infrastructural conditions and their implications for CBE implementation. A document analysis guide was used to examine relevant school records and documents relating to infrastructure and curriculum implementation. The use of multiple data collection instruments enabled triangulation of information from different sources and strengthened the credibility of the findings.

Pretesting of research instruments

Pilot testing is a process of conducting attest of the research questions using a different studying population but with a similar characteristics as the study population to be studied (Sekaran & Bougie 2016). The pilot study was made in Kikuyu sub County of Kiambu County. This was due to the area have similar social educational characteristic with Kabete sub county.

Reliability

Instrument reliability is the extent to which a research instrument provides similar results on different situations under similar conditions. It is the degree of consistency with which it measures whatever it is meant to measure (Bell et al., 2022). The researcher used test retest method which entailed administering the same instruments to the learners, JS teachers, school head teachers and parents in the piloted schools two weeks before actual field study. The results attained were correlated thus confirming the instrument was reliable for research.

Data Collection Procedure

The researcher obtained the necessary authorization before commencing data collection. The selected respondents were informed about the purpose of the study and the procedures involved. Questionnaires were administered to selected respondents, while interviews with head teachers were conducted at times convenient to the participants. Relevant school documents were also examined with permission from the respective school authorities.

Response Rate

The study targeted 338 respondents. A total of 317 respondents participated in the study, giving an overall response rate of 94%. The response rate was calculated using:

Response rate = (Number of respondents who participated ÷ Number of respondents sampled) × 100

Response rate = $(317 \div 338) \times 100 = 93.7\%$

Data Analysis

Quantitative data were coded and analyzed using the Statistical Package for the Social Sciences (SPSS) Version 26. Descriptive statistics, including frequencies, percentages, means, and standard deviations, were used to summarize the quantitative findings.

Qualitative data obtained through interviews were analyzed thematically. Responses were organized into themes corresponding to the study objective. Quantitative and qualitative findings were then compared and integrated during interpretation.

RESEARCH FINDINGS

Infrastructural Challenges Affecting Implementation of CBE

The study sought to examine infrastructural challenges affecting the implementation of Competency-Based Education in public Junior Secondary Schools in Kabete Sub-County. The findings indicated that inadequate infrastructure was a significant challenge affecting effective curriculum implementation.

The major infrastructural challenges identified were inadequate classrooms, overcrowding, insufficient science laboratories, limited ICT facilities, inadequate libraries, inadequate sanitation facilities, lack of workshops, and limited specialized learning spaces for creative arts and technical subjects.

Inadequate Classrooms and Overcrowding

Respondents reported that some schools did not have sufficient classrooms to accommodate the increasing number of Junior Secondary School learners. Existing classrooms were reported to have been initially designed for primary school learners and were therefore under pressure following the introduction of JSS.

Overcrowded classrooms may make it difficult for teachers to organize group activities, provide individualized attention, supervise practical activities, and conduct continuous assessment effectively. For example: “A total of 300 respondents 95% agreed that classrooms were inadequate, while 17, 5% disagreed.”

Inadequate Science Laboratories

The study established that inadequate science laboratory facilities were another major infrastructural challenge. Some schools lacked fully equipped laboratories, while others had limited facilities that could not adequately accommodate all learners.

The shortage of laboratories affected the implementation of practical learning because teachers had limited opportunities to conduct experiments and demonstrations. Consequently, some science lessons relied more heavily on theoretical explanations.

A head teacher explained:

“The greatest challenge we face is inadequate classrooms and laboratories. Teachers are forced to improvise practical lessons because the required facilities are unavailable.”

This finding demonstrates how infrastructure can directly influence the implementation of learner-centred and experiential approaches under CBE.

Limited ICT Facilities

The study further established that ICT infrastructure was inadequate in some public Junior Secondary Schools. The challenges included insufficient computers, limited internet connectivity, inadequate projectors, and insufficient digital learning equipment.

One respondent stated:

“Our school has only one computer room shared by all learners. This limits digital learning under the Competency-Based Curriculum.”

Limited ICT facilities may constrain opportunities for learners to develop digital competencies and for teachers to integrate technology into classroom instruction.

Inadequate Libraries and Specialized Learning Spaces

Respondents also identified inadequate libraries and specialized learning spaces as challenges affecting implementation of CBE. The absence of inadequacy of workshops and spaces for creative arts and technical subjects limits opportunities for practical and project-based learning.

Since CBE emphasizes the application of knowledge and development of practical competencies, specialized learning spaces are important for providing learners with opportunities to practice and demonstrate acquired skills.

Inadequate Sanitation Facilities

Inadequate sanitation facilities were also reported as an infrastructural concern. Where sanitation facilities are insufficient for the number of learners, the school environment may become less conducive to effective teaching and learning. The availability of adequate, safe, and appropriate sanitation facilities is therefore an important component of a supportive school learning environment.

Summary of Major Infrastructural Challenges

The major challenges identified by the respondents are summarized in table 2:

Table 2: Summary of Major Infrastructural Challenges

Infrastructural challenge	SD f (%)	D f (%)	N f (%)	A f (%)	SA f (%)	Mean	SD
Inadequate classrooms	8 (2.5)	12 (3.8)	22 (6.9)	90 (28.4)	185 (58.4)	4.36	0.95
Overcrowding	10 (3.2)	14 (4.4)	25 (7.9)	95 (30.0)	173 (54.6)	4.28	1.00
Inadequate science laboratories	18 (5.7)	20 (6.3)	48 (15.1)	92 (29.0)	139 (43.8)	3.99	1.17
Inadequate ICT facilities	15 (4.7)	18 (5.7)	43 (13.6)	96 (30.3)	145 (45.7)	4.07	1.12
Inadequate libraries	20 (6.3)	25 (7.9)	53 (16.7)	98 (30.9)	121 (38.2)	3.87	1.19
Inadequate sanitation facilities	16 (5.0)	22 (6.9)	53 (16.7)	99 (31.2)	127 (40.1)	3.94	1.14
Inadequate workshops	22 (6.9)	25 (7.9)	56 (17.7)	99 (31.2)	115 (36.3)	3.82	1.20
Inadequate creative arts/technical spaces	25 (7.9)	28 (8.8)	58 (18.3)	96 (30.3)	110 (34.7)	3.75	1.24

Note. N = 317. SD = *Strongly Disagree*; D = *Disagree*; N = *Neutral*; A = *Agree*; SA = *Strongly Agree*; M = *Mean*; SD = *Standard Deviation*.

The table indicates that inadequate classrooms constituted the most prominent infrastructural challenge affecting the implementation of competency-based education. A

total of 275(86.8%) respondents agreed or strongly agreed that classroom were inadequate, yielding a mean score of 4.36(SD=0.95). Overcrowding was the second most prominent challenge with 268(84.5%) respondents agreeing or strongly agreeing (M=4.28, SD=1.00). inadequate ICT facilities were also substantially reported with 241(76.0%) respondents agreeing or strongly agreeing that facilities were inadequate (M= 4.07, SD = 1.12). Inadequate science laboratories were reported by 231(72.9%) respondents (M =3.99, SD =1.17). Inadequate creative arts and technical spaces recorded the lowest mean of 3.75 (SD =1.24), although 206 (65.0%) respondents still agreed that these facilities were inadequate. Overall, the findings suggest that infrastructure remain a considerable constraint to effective implementation of CBE in the sampled junior secondary schools.

DISCUSSION OF FINDINGS

The findings demonstrate that inadequate infrastructure remains an important challenge to effective implementation of Competency-Based Education in public Junior Secondary Schools in Kabete Sub-County. The shortage of classrooms and resulting overcrowding may limit the implementation of learner-centered pedagogical approaches. CBE requires learners to participate actively through group work, discussions, projects, experimentation, and other collaborative activities. Such activities can become difficult when classroom space is insufficient.

The findings concerning inadequate science laboratories indicate that infrastructure can affect the practical component of CBE. Practical learning requires appropriate spaces, equipment, and materials that enable learners to apply theoretical knowledge. Where laboratories are unavailable or inadequate, teachers may rely more heavily on theoretical instruction.

The study also found that ICT infrastructure was inadequate. Limited access to computers, internet connectivity, projectors, and digital learning resources may restrict the integration of technology into teaching and learning. This may consequently affect opportunities for learners to develop digital competencies. The findings are consistent with Too et al. (2024), who identified infrastructure and resource preparedness as important factors in CBC implementation in public schools in Baringo County. The findings also support Akala (2021), who noted that implementation of Kenya's curriculum reforms requires adequate institutional capacity and resources. The implication is that curriculum policy alone is insufficient; appropriate physical and material conditions are necessary to translate curriculum expectations into classroom practice.

From the perspective of Systems Theory, infrastructure constitutes an essential input into the educational system. When infrastructure is inadequate, the teaching and learning processes are affected, which may subsequently influence educational outputs. Thus, improving infrastructure is necessary for strengthening the overall functioning of the Junior Secondary School system.

Conclusion

The study concludes that infrastructural challenges constitute a significant barrier to effective implementation of Competency-Based Education in public Junior Secondary Schools in Kabete Sub-County.

The major challenges identified included inadequate classrooms, overcrowding, insufficient science laboratories, limited ICT facilities, inadequate libraries, inadequate sanitation facilities, lack of workshops, and limited specialized learning spaces.

These deficiencies affect learner-centred instruction, practical learning, digital learning, continuous assessment, learner participation, and effective curriculum delivery. Addressing infrastructural gaps is therefore essential for ensuring that the objectives of Competency-Based Education are effectively achieved.

Recommendations

Increased government funding: The Ministry of Education should increase funding specifically for infrastructure development in public Junior Secondary Schools.

Construction of classrooms and laboratories: National and county-level education stakeholders should prioritize the construction and equipping of additional classrooms and science laboratories in schools experiencing shortages.

Improvement of ICT infrastructure: Relevant government agencies should strengthen ICT infrastructure by providing adequate computers, internet connectivity, projectors, and other digital learning resources.

Development of specialized learning spaces: Schools should prioritize the establishment and equipping of workshops, creative arts spaces, libraries, and other specialized facilities required for competency-based learning.

Improvement of sanitation facilities: Schools should ensure that adequate and appropriate sanitation facilities are provided to meet the needs of the growing JSS population.

Stakeholder partnerships: Boards of Management should strengthen partnerships with government agencies, county governments, development partners, non-governmental organizations, communities, and other stakeholders to mobilize additional resources for infrastructure development.

Long-term infrastructure planning: Public Junior Secondary Schools should develop long-term infrastructure development plans based on projected enrolment and the infrastructure requirements of the Competency-Based Education curriculum.

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