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Preparedness of Schools to Implement Competence Based Science Curriculum in Lower Primary Schools in Nairobi City County, Kenya

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Abstract
Competency-Based Education (CBE) is a student-centered approach to teaching and learning that has been implemented in Kenya since 2019. It is now applied across all fields of study, including science, which emphasizes different competencies compared to the arts. This study sought to assess the preparedness of lower primary schools in Nairobi City County for the implementation of the competency-based science curriculum. The specific objectives were to evaluate the extent of school readiness, examine the level of curriculum implementation, and identify challenges hindering the process. The study adopted a descriptive survey design and was guided by Jerome Bruner's Constructivist Theory. The target population comprised 124 primary schools, including 424 science teachers and 124 head teachers in Westlands Sub-County. Respondents were proportionately drawn from the five wards, with 12% sampled from each. Data were collected using structured questionnaires based on a five-point Likert scale. A pilot study was conducted to validate the research instruments and ensure reliability. Data analysis employed descriptive statistics, including frequencies and percentages, using SPSS version 27.0. Findings were presented in tables and graphs for clarity. The results revealed that school preparedness had a positive influence on CBE implementation, while challenges demonstrated a negative correlation with the dependent variable. Specifically, correlation analysis showed negative associations between CBE implementation and school readiness ($r = –0.375$), factors influencing preparedness ($r = –0.272$), and implementation levels ($r = –0.032$). A positive relationship ($r = 0.251$) was observed only for challenges affecting implementation. Regression coefficients were 0.035 for school preparedness, 0.016 for influencing factors, 0.020 for implementation levels, and –0.353 for challenges, indicating that obstacles significantly hinder implementation. Furthermore, the study concluded that the implementation of the CBE science learning domain plays a vital role in improving learner competencies, yet its success is constrained by inadequate teaching materials, insufficient infrastructure, and poorly equipped science laboratories. Furthermore, findings highlighted a gap in teacher training, with many science educators lacking the necessary skills to align effectively with CBE requirements. The study recommends increased allocation of resources to strengthen infrastructural capacity in schools, with particular emphasis on equipping science laboratories for hands-on learning. Additionally, quarterly professional development seminars for science teachers should be organized to facilitate knowledge sharing, enhance pedagogical practices, and promote smooth and sustainable implementation of the competency-based science curriculum.

Keywords: Competency-Based Education, Science Curriculum, School Preparedness, Teacher Training, Implementation Challenges, Lower Primary Schools, Nairobi City County

Introduction

National curricula serve as vehicles through which countries equip citizens with knowledge, competencies, values, and dispositions necessary for economic participation, social cohesion, personal advancement, and national prosperity (UNESCO, 2019) [5]. Effective curriculum frameworks must therefore balance individual learner development needs with broader national

development objectives. The International Bureau of Education (IBE-UNESCO) characterizes curriculum as an interconnected system of educational elements—policy frameworks, strategic planning, content development, teacher preparation, learner engagement, and assessment practices—that collectively advance lifelong learning capabilities.

During the 1960s, American educators began questioning whether traditional schooling adequately prepared students for civic and professional life. Concerns mounted that conventional educational systems produced graduates who lacked practical capabilities for meaningful societal contribution. These critiques prompted the development of Competency-Based Education (CBE) in the United States. The approach rested on the premise that curricula should transcend mere knowledge transmission to deliberately cultivate attitudes and capabilities equipping learners with comprehensive capacities to address authentic life challenges.

Within CBE frameworks, knowledge and skill application encompasses abilities to collect, evaluate, organize, and synthesize information; communicate ideas effectively; function collaboratively; apply mathematical reasoning and scientific inquiry; and nurture creativity, innovation, and systematic problem-solving. Kenya's reformed educational curriculum similarly aimed to actualize fundamental national educational aspirations: promoting national cohesion, fostering individual learner growth and self-confidence, and instilling sound ethical principles.

Statement of the Problem

The Kenyan government introduced the Competency-Based Curriculum (CBC) in 2017 to replace the 8-4-4 education system, with full implementation beginning in 2019. The CBC aims to develop learners holistically by focusing on competencies rather than theoretical knowledge alone. However, the transition from the traditional content-based approach to a competency-based model has presented significant challenges, particularly in science education at the lower primary level. Despite the government's commitment to CBC implementation, concerns have emerged regarding schools' preparedness to effectively deliver the science curriculum. Key challenges include inadequate teaching and learning materials, insufficient teacher training, limited infrastructure, and poorly equipped science laboratories.

While previous studies have examined CBC implementation broadly, limited research has focused specifically on school preparedness for the science learning domain in lower primary schools within Nairobi City County. This study therefore sought to fill this gap by assessing the extent of school readiness, examining implementation levels, and identifying specific challenges hindering effective delivery of the competency-based science curriculum in lower primary schools.

Purpose of the Study

The purpose of this study was to assess the preparedness of lower primary schools in Nairobi City County for the implementation of the competency-based science curriculum.

Specific Objectives

The study was guided by the following specific objectives:

1. To evaluate the extent of school readiness for implementing the competency-based science curriculum in lower primary schools.
2. To examine the level of implementation of the competency-based science curriculum in lower primary schools.
3. To identify challenges hindering the implementation of the competency-based science curriculum in lower primary schools.

Methodology

Research Design

The study adopted a descriptive survey design. This design was appropriate as it enabled the researcher to systematically collect and analyze data about the current state of school preparedness and CBC implementation without manipulating variables. The descriptive survey approach facilitated the gathering of comprehensive information from a large population within a reasonable timeframe and cost.

Study Location and Target Population

The study was conducted in Westlands Sub-County, Nairobi City County, Kenya. The target population comprised 124 primary schools, 424 science teachers, and 124 head teachers. Westlands Sub-County was selected due to its diverse school types (public and private) and its representative nature of urban primary schools in Nairobi.

Sampling Techniques and Sample Size

The study employed proportionate stratified random sampling. Respondents were drawn proportionately from five wards within the sub-county, with 12% sampled from each ward. This approach ensured representativeness across different geographical areas and school types within the study location.

Data Collection Instruments

Data were collected using three instruments: structured questionnaires for science teachers, interview guides for school heads, and observation checklists. The questionnaires were based on a five-point Likert scale to measure respondents' perceptions and experiences regarding CBC implementation. A pilot study was conducted to validate the research instruments and ensure reliability before the main data collection exercise.

Data Analysis

Data analysis employed descriptive statistics, including frequencies, percentages, means, and standard deviations. Correlation and regression analyses were conducted to examine relationships between variables. All statistical analyses were performed using SPSS version 27.0, and findings were presented in tables and graphs for clarity and easy interpretation.

Results and Discussion

School Readiness for CBC Implementation

The findings revealed that school preparedness had a significant influence on CBC implementation. Correlation analysis showed a negative association between CBE implementation and school readiness ($r = –0.375$, $p < 0.05$). This counterintuitive finding suggests that despite efforts to prepare schools, gaps remain in translating readiness into effective implementation. The regression coefficient of 0.035 for school preparedness indicated that while readiness contributes positively to implementation outcomes, the

magnitude of this effect remains modest.

Key aspects of school readiness examined included availability of teaching and learning materials, adequacy of infrastructure, and laboratory equipment. The study found that most schools lacked sufficient science teaching aids, with many relying primarily on textbooks and chalk-board demonstrations. This finding aligns with previous research highlighting resource constraints as a major impediment to effective CBC implementation in Kenyan schools.

Implementation Levels of CBC Science Curriculum

The study examined the extent to which the CBC science curriculum had been implemented in lower primary schools. Results indicated that implementation levels varied considerably across schools. The correlation analysis revealed a weak negative relationship ($r = –0.032$) between implementation levels and overall CBC effectiveness. The regression coefficient of 0.020 suggested minimal impact of current implementation strategies on desired learning outcomes.

Teachers reported using various pedagogical approaches including inquiry-based learning, hands-on activities, and collaborative group work. However, the effectiveness of these methods was compromised by large class sizes, limited time allocation for science lessons, and insufficient practical materials. Many teachers expressed frustration with the gap between CBC's ideals and classroom realities.

Teacher Training and Competence

A significant finding of this study was the inadequacy of teacher training for CBC implementation. Many science educators lacked the necessary skills and knowledge to effectively deliver competency-based lessons. While most teachers had attended CBC orientation workshops, these were often brief and focused more on theoretical understanding than practical application. Teachers expressed the need for ongoing professional development, particularly in areas such as formative assessment, differentiated instruction, and integration of technology in science teaching.

Challenges Hindering CBC Implementation

The study identified several challenges that significantly hinder CBC implementation. The correlation analysis revealed a positive relationship ($r = 0.251$) between identified challenges and implementation difficulties. More critically, the regression coefficient of –0.353 for challenges indicated that obstacles substantially impede successful implementation. Key challenges included:

1. **Inadequate Teaching and Learning Materials:** Most schools lacked sufficient science kits, models, charts, and other essential teaching aids. This forced teachers to rely on theoretical explanations rather than hands-on demonstrations, contradicting CBC's experiential learning philosophy.
2. **Insufficient Infrastructure:** Many schools, particularly public institutions, lacked dedicated science laboratories or activity rooms. Where laboratories existed, they were often poorly equipped and maintained.
3. **Large Class Sizes:** Overcrowded classrooms made it difficult to conduct practical activities and provide individualized attention required by CBC.
4. **Limited Time Allocation:** Teachers reported that the time allocated for science lessons was insufficient for covering the curriculum comprehensively while incorporating hands-on activities.
5. **Assessment Challenges:** Teachers struggled with formative assessment techniques and maintaining comprehensive learner portfolios as required by CBC.

Conclusions

The study concludes that while the Competency-Based Curriculum represents a progressive approach to education, its implementation in lower primary science education faces significant challenges. School preparedness, though recognized as important, has not translated into effective implementation outcomes. The implementation of the CBC science learning domain plays a vital role in improving learner competencies, yet its success is severely constrained by inadequate teaching materials, insufficient infrastructure, and poorly equipped science laboratories.

Furthermore, there exists a substantial gap in teacher training, with many science educators lacking the necessary pedagogical skills to align effectively with CBC requirements. The negative correlation between various preparedness factors and implementation success suggests that current readiness efforts may be misdirected or insufficient in addressing the actual needs of schools and teachers.

The strong negative influence of challenges on implementation ($\beta = –0.353$) underscores the urgency of addressing infrastructural, resource, and capacity-building deficits if CBC is to achieve its intended goals.

Recommendations

Based on the findings, the study makes the following recommendations:

1. **Increased Resource Allocation:** The government and educational stakeholders should prioritize increased allocation of resources to strengthen infrastructural capacity in schools, with particular emphasis on equipping science laboratories with appropriate apparatus, materials, and safety equipment for hands-on learning.
2. **Continuous Professional Development:** Quarterly professional development seminars for science teachers should be organized to facilitate knowledge sharing, enhance pedagogical practices, and address emerging challenges. These should focus on practical teaching strategies, formative assessment techniques, and integration of locally available materials in science instruction.
3. **Development of Teaching Aids:** Schools should be supported to develop low-cost, locally sourced teaching and learning materials to supplement commercial science kits. Teachers should receive training in improvisation techniques to overcome resource constraints.
4. **Infrastructure Development:** Priority should be given to constructing and equipping dedicated science activity rooms in schools that lack proper laboratory facilities. Where full laboratories are not immediately feasible, basic activity spaces with storage for science materials should be established.
5. **Class Size Management:** School administrators and education authorities should explore strategies to reduce class sizes in science lessons, possibly through parallel streaming or scheduling adjustments, to enable more effective hands-on learning.

6. **Curriculum Time Adjustment:** The Kenya Institute of Curriculum Development (KICD) should review the time allocation for science lessons to ensure adequate coverage while allowing for the practical, inquiry-based activities central to CBC.

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