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The Relationship between Availability of Information Communication Technology (ICT) Resources and the Integration of Technology in the Implementation of Competency-Based Curriculum (CBC) in Primary Schools

[1]*Salina J. Bartilol, [2]Dr. Mary Kerich Egesa & [3] Dr. Alice Yungungu

[1]*PhD Student, Department of Curriculum, Instruction and Educational Media, School of Education Moi University, [2]Proffessor, Department of Curriculum Instruction and Educational Media, School of Education, Moi University & [3]Professor, Department of Curriculum Instruction and Educational Media, School of Education, Moi University

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Abstract

The transformative nature of technology in the education system has made many countries globally, including Kenya to make new policies, equip institutions with resources and train the teachers. With the introduction of the Competency-Based Curriculum (CBC) in Kenya, there is a noticeable gap in understanding how technology can be effectively integrated into the implementation of CBC to enhance the teaching and learning process. This gap is particularly evident in primary schools within rural or less-resourced areas, such as Keiyo-South Sub-County, where teachers may face unique challenges in fully adopting and integrating technology despite the availability of resources and training. Therefore, the purpose of this study was to establish the relationship between availability of Information Communication Technology (ICT) resources in the implementation of CBC in primary schools. The study was anchored on Rodger's diffusion of innovation theory. The study used concurrent mixed methods design. It targeted 1256 teachers and 129 head teachers from 129 schools. Krejcie and Morgan table gave a sample of 297 teachers and 97 schools and 26 head teachers were from Kerlinger recommendation of 20% of the targeted population. proportionate stratified random sampling was used to get the zones. Teachers' questionnaire and head teachers' interview schedule were used to collect data. Qualitative data was analyzed thematically while quantitative data was analyzed using descriptive and inferential statistics with the help of Statistical Package for Social Sciences (SPSS) version 25. The study established a significant positive relationship between availability of ICT resources and the implementation of CBC ($r=.240$; $p=.000<.01$). Unavailability, inadequacy and malfunctioning of ICT resources

hindered effective integration of technology. The study concluded that technology integration was minimal due to unavailable, inadequate and malfunctioning ICT resources and limited digital literacy skills. The study recommends that the government, school management and parents should increase the budget for adequate ICT resources and training of teachers.
Keywords: Competency-Based Curriculum (CBC), Integration of Technology, Implementation, Information Communication Technology (ICT)

Introduction

Background of the Study

The impact of technology has been felt in every aspect of humanity, including the education sector where its potential benefits have been realized in the teaching and learning processes. Researchers have found that integrating technology into the education system has the ability to improve institutional methodology and the quality of learning (Akram & Yang, 2021). The use of digital technologies and content enhances learning outcomes of learners, especially during their initial stages of education such as in pre-primary and primary schools (Achieng et al., 2024). Digital tools facilitate active learning, collaboration and personalized learning, transforming traditional instructional methods and promoting students' engagement and motivation (Langat, 2025). By integrating educational technology into the curricular, schools can help students develop digital literacy, critical thinking, problem-solving, and collaboration skills that are vital for navigating the complexities of the digital age (Rabir, 2024).

Due to the potential of technology integration, governments worldwide have reviewed their educational policies with the belief that improving ICT integration in schools would have far-reaching pedagogical and educational effects. Some countries have upgraded their requisite technological infrastructure and ICT-based instruments for ICT-based teaching and learning (Mohammed et al., 2024). For instance, the Australian government provides regular professional development to teachers to keep up with technological advancements (Acara, 2021). Similarly, the Kenyan government promised to invest heavily on ICT availability and teacher training (Ministry of Education, 2021). The Zimbabwean government established the National technology policy and teacher-education policy which mandated that every student teacher receive technology education (Dzinoreva & Mavunga, 2022).

However, despite many governments' efforts to upgrade their ICT resources for successful technology integration, concerns have been raised about the projected impact globally. Teachers often lack the requisite training and support to develop ICT competencies, especially in low-resourced settings in developing countries (Adnan et al., 2024). Even when digital tools and skills are available, integrating them into the curriculum in a manner that enhances teaching and learning remains challenging (Akcil et al., 2021). A qualitative study in Spain found that expectations around ICT impact in education had not been satisfactorily effective as professors lacked adequate training on technology integration (Liesa-orus et al., 2020). Similarly, Canadian teachers had basic computer skills but faced challenges in lesson presentation due to lack of training and inadequate ICT resources (Baker & James, 2022).

Regionally, low technology integration in classrooms has been observed across Africa. In Nigeria, state universities faced obstacles like inadequate electricity, poor internet connectivity, and lack of ICT skills (Okwu et al., 2023). Ghanaian integrated science teachers

reported underutilization of IBOX due to unavailable ICT facilities, particularly among older teachers (Awuni et al., 2023). Ugandan secondary schools implementing e-learning had inadequate tangible and intangible ICT resources (Kyomuhendo et al., 2024).

In Kenya, studies reveal persistent challenges in technology integration. Public universities faced complex search functions and insufficient filters in digital platforms, leading to inefficient e-content access (Nakhumicha & Tenya, 2024). Primary school teachers in Baringo County remained inadequately trained to utilize technology effectively in CBC implementation (Chepkilot et al., 2024). Many teachers encountered barriers in acquiring technological skills due to inadequate training opportunities and limited ICT infrastructure (Ngina, 2024). In Elgeyo-Marakwet County, studies on technology integration are limited. Kiptoo and Kitainge (2020) found teachers were not utilizing CBC teaching methods despite training, while Jeremy et al. (2018) showed rural women had limited ICT access in Keiyo-South Constituency.

Most previous research focused on ICT integration in universities and teacher training colleges where it wasn't compulsory (Twabaze, 2023; Ireri et al., 2024). Others examined technology in secondary schools without CBC implementation (Nokiri et al., 2021; Kaugi, 2024). Some studies addressed CBC implementation challenges with little focus on ICT integration (Kidega & Song, 2024; Oloo, 2020). Those combining technology and CBC were conducted in other counties, not Elgeyo-Marakwet (Chepkilot et al., 2024; Murithi & Yoo, 2021). Jeremy et al. (2018) examined ICT and poverty reduction in Keiyo-South, leaving a gap in studying technology integration in CBC implementation in primary schools. Therefore, this study was to establish the relationship between availability of Information Communication Technology (ICT) resources in the implementation of CBC in primary schools in Keiyo-South Sub-County, Elgeyo-Marakwet County, Kenya.

Statement of the Problem

The use of digital tools in the education system facilitates active learning, transforms traditional instructional methods and promotes students' engagement and motivation (Lagat, 2025). However, technology integration is a multidimensional and complex process which involves school readiness, availability of ICT resources and adequate finances (Akcil et al., 2021; Okwu et al., 2023 & Kyomuhendo et al., 2024). Most of the literature reviewed revealed that majority of the teachers in primary schools in Kenya were still implementing technology-oriented CBC curriculum using traditional methods due to limited ICT infrastructure (Chepkilot et al., 2024; Nakhumicha &Tenya, 2024; & Akcil, 2021).

However, most of these studies focused on ICT integration in higher levels of education such as universities, teacher training colleges and secondary schools where ICT integration was not compulsory and CBC had not yet been introduced in their curricula. It was observed that a majority of the studies reviewed were only concerned about the challenges faced by the teachers during the implementation of CBC with little focus on ICT integration. Those studies which sought to establish the relationship between technology integration and the implementation of CBC were carried out in other counties. Furthermore, there seems to be limited studies on the integration of technology in the implementation of CBC in Keiyo-South Sub-County. Therefore, this study sought to establish the relationship between availability of

Information Communication Technology (ICT) resources in the implementation of CBC in primary schools in Keiyo-South Sub-County, Elgeyo-Marakwet County, Kenya.

Objectives of the Study

The study objective was to determine the relationship between availability of ICT resources and the integration of technology in the implementation of competency-based curriculum (CBC) in primary schools in Keiyo-South Sub-County, Elgeyo-Marakwet County, Kenya.

Hypotheses of the Study

The study was guided by the following research Hypothesis:

H_0: There is no significant relationship between availability of ICT resources and the integration of technology in the implementation of competency-based curriculum in primary schools

Theoretical Framework

Diffusion of Innovations Theory

This study is anchored on the Diffusion of Innovations Theory (Rogers, 2003), which explains how new ideas and technologies are adopted within a social system over time. The theory posits that the adoption of an innovation such as Information and Communication Technology (ICT) in education is influenced by factors such as relative advantage, compatibility, complexity, trialability, and observability.

In the context of this study, the availability of ICT resources in schools can be viewed as a prerequisite for the adoption and integration of technology in the implementation of the Competency-Based Curriculum (CBC). According to Rogers (2003), innovations are more likely to be adopted when they are perceived as beneficial, easy to use, and compatible with existing practices. The study, therefore, assumes that the more available and functional ICT resources are in schools such as computers, tablets, internet connectivity, and electricity, the more likely it is that teachers will integrate them into CBC implementation.

This theoretical lens is appropriate because it underscores the importance of resource readiness in the adoption process. As established in the study, most schools in Keiyo-South Sub-County face infrastructural and financial challenges that hinder access to adequate ICT resources. These limitations slow down or prevent the innovation-decision process that leads to full adoption and sustained use of ICT in teaching and learning. The theory also emphasizes the role of change agents such as the Ministry of Education and school leaders in facilitating diffusion through training, support, and provision of infrastructure. By applying the Diffusion of Innovations Theory, this study provides a conceptual basis for examining how the availability of ICT resources influences the integration of technology in CBC implementation in public primary schools.

Literature Review

Importance of Technology Integration in the Implementation of CBC

Technology use in education had become an indispensable aspect in the contemporary education system and many governments have invested in ICT to foster the quality of education in their countries (Mohammed et al., 2024). In addition, Hennessy et al. (2023) stated that increasing the use of technology across the education system offers potential

benefits for mediating the implementation new curricula such as CBC. They indicated that educational technology could facilitate the effective delivery of lessons in primary schools. Furthermore, Idowu (2022) revealed that using technology in teaching would enable the teachers to efficiently analyze students' learning activities in and outside the classroom. This could enhance honest and detailed feedback which would promote students' outcomes. Additionally, Mensch and Ampadu (2024) posited that computer-assisted instruction promotes student-centered approaches and active engagement. They further observed that technology-based instruction offers customized educational experiences designed to meet the unique needs and learning preferences of each individual student.

Relationship between Availability of ICT Resources and the Integration of Technology in the Implementation of CBC

Some researchers argued that transforming traditional educational practices needs adequate educational infrastructure in schools which establishes a prerequisite for the teachers to effectively integrate technology in their pedagogical practices which in turn enhances students 'learning (Akram, 2021).

Sweeney (2024) examined students' experiences in educational technology use to facilitate university learning in United Kingdom (UK). The author established that the UK government had invested heavily on educational technologies in all levels of education. However, the author opined that more ICT resources needed to be supplied to meet the learners', teachers' and administrative demands. The above study was carried out in Universities in UK whose school and classroom environments are quite different in terms of ICT resources. The study investigated technology integration in the UK university curriculum which is not similar to Kenya's CBC curriculum. The current study surveyed teachers 'integration of technology in the implementation of CBC in primary schools in Keiyo-South Sub-County in Kenya.

Adu and Zondo (2024) carried out an investigation on the integration of ICT in teaching and learning in primary schools in South Africa. Their findings revealed that there were inadequate ICT tools and content to adequately integrate technology in the teaching of economics in grades 4-12. The researchers concluded that lack of educational technologies in most of the schools forfeited the objectives of ICT usage in teaching and learning. This study focused its attention on technology integration in one learning area in South Africa. The current study investigated the integration of technology in CBC implementation in all learning areas in primary schools from grades 1-6 in Keiyo-South Sub-County in Kenya.

Mapisa and Makena (2024) investigated the impact of ICT adoption in enhancing teaching and learning in primary schools of Amathole East District in Eastern Cape in South Africa. The authors established that all government aided primary schools did not have ICT resources such as computers in the classrooms, Internet connections, projectors, websites, emails, computer labs and whiteboards. Their findings further revealed that ICT resources were not accessible to the teachers and students because they were not available in most primary schools. These researchers concluded that the government and the school administration lacked the financial power to budget for the purchase of the necessary educational technologies or the installation of ICT infrastructure which made the integration of e-learning impossible in primary schools in Amathole District in South Africa. The integration of technology in private primary schools was not revealed by this study which creates a gap in

addition to the South Africa primary school context which is different from Kenya's. The researcher carried out an investigation on the teachers' integration of technology in the implementation of CBC in public and private primary schools in Keiyo-South Sub-County in Kenya.

Cuamba et al. (2021) explored internet use by rural students in Mozambique. Their study results indicated that the students did not use the Internet because of the structural and political issues that hindered internet connectivity in schools. In addition, their findings indicated that the low purchasing power of households did not permit them to acquire educational technologies. They therefore concluded that the lack of internet connectivity in rural schools limited the students' research capabilities and their opportunities to widen their knowledge and interaction with the world. The researchers examined Learners' use of technology in rural primary and secondary schools in Mozambique whose national curriculum might not be CBC. This study investigated teachers' integration of technology in the implementation of CBC in primary schools in Kenya.

Aikins and Arthur-Nyarko (2019) examined the challenges facing ICT implementation in primary schools in Ghana and revealed that majority of the schools did not have computer labs for practical ICT lessons. In addition, their findings showed that most of the schools lacked ICT equipment such as scanners, digital cameras and microphones and the equipment which were available like the projectors and printers were inadequate. According to their data, the teachers and students were not given regular access to school computers yet they did not have their personal computers at home. Ghanaian curriculum and primary school contexts are different from those of Kenya. The current study therefore investigated the integration of technology in the implementation of CBC in primary schools in Kenya.

Murithi and Yoo (2021) on technology integration in the implementation of CBC in public primary schools in Kajiado North, Sub-County found out that most of the schools lacked internet connectivity and projectors which hindered the teachers from effectively infusing technology in their lessons. It was an experimental study which used ANOVA but the current research was a correlational survey in which Pearson correlation statistics was used. The previous study was carried out in Kajiado North Sub-County while the current one took place in Keiyo-South Sub-County.

Mwita (2023) assessed the teachers' preparedness on the implementation of CBC in public primary schools in Migori County. The research results indicated that the ICT resources were either unavailable or inadequate which made most of teachers depend largely on textbooks and chalkboards as exclusive teaching/learning resources. This study focused on the general preparedness of teachers in primary schools in Migori county and the current study dealt with a specific issue (technology integration) in primary schools in Elgeyo-Marakwet County. Mwita was less concerned with technology integration which was mainly focused by the current study.

Asava (2021) examined the influence of teacher pedagogies on the implementation of CBC in public primary schools in Westlands Sub-County Nairobi City County in Kenya. The results indicated that most of the ICT resources were limited. The findings further revealed that there were inadequate functioning digital devices available for the implementation of CBC. This

study was carried out in a city but the current one was in primary schools in a rural area. It was on the influence of teachers 'teaching methods on CBC implementation but the researcher's study was on teachers' integration of technology on the implementation of CBC. Njagi et al. (2020) analyzed the challenges facing ICT integration in managing secondary schools in South Rift region in Kenya. Their study results indicated that most of the public secondary schools had insufficient educational technologies and inadequate ICT infrastructure. The teachers in their study confirmed that most of the ICT resources available in schools were donations or projects from private companies or foreign donors and when they exited, the government did not take the responsibility of equipping secondary schools with the necessary technologies. Their findings further revealed that the few ICT resources available had challenges such as regular breakdown, poor maintenance, attack by viruses, cybercrime, insecurity, power outages and unreliable internet connectivity. This study analyzed technology integration for the management of secondary schools. It was a comparative study of day and boarding schools in South Rift. The current one surveyed technology integration in the implementation of CBC in primary schools in Keiyo-South Sub-County.

Research Methodology

A mixed methods research approach was used with the assumption that integrating both quantitative and qualitative data yields more comprehensive insights. The study employed a concurrent embedded design, which involves collecting both quantitative and qualitative data during a single data collection phase. However, the quantitative approach was predominant, while the qualitative component supported and added context to the quantitative findings (Creswell, 2014; 2018).

Research Design

The research design was a survey, which enabled the collection of quantitative and qualitative data within a short period. The survey design was chosen due to its ability to generate information from large groups of respondents in a cost-effective manner. Specifically, a correlational survey design was used to describe and measure the relationships between teachers' integration of technology and the implementation of the Competency-Based Curriculum (CBC) (Creswell, 2014). Although correlation does not imply causation, the study interpreted the relationships cautiously and acknowledged them as a basis for further studies (Marczyk et al., 2005).

Target Population and Sample Size

The target population included 129 primary schools, 1256 teachers, and 129 head teachers. Based on Krejcie and Morgan's (1970) sample size table, the study sampled 297 teachers and 97 schools. Proportionate stratified random sampling was used to ensure divisional representation, while Kerlinger's (1973) 20% rule was used to purposively select 26 head teachers for qualitative interviews. This sampling method ensured that the sample accurately reflected the population distribution.

Data Collection Instruments

Data collection instruments included a teacher questionnaire and head teacher interview schedule. The questionnaire was researcher-designed and structured around the study objectives, including sections on background information, availability of ICT resources,

professional development, age, attitude, and CBC implementation. The tool used ordinal and interval scales for measurement. The interview schedule gathered qualitative data to address gaps left by the questionnaire, allowing the researcher to gain deeper understanding of the phenomena under study (Creswell & Creswell, 2018).

Data Presentation and Analysis

Data analysis for quantitative data was done using SPSS version 25. The process involved coding responses, computing descriptive statistics (frequencies, means, standard deviations), and testing hypotheses using Pearson Product Moment Correlation. The study set confidence levels at 95% and 99% to determine the strength and significance of relationships. For qualitative data, thematic analysis was employed. Interview responses were coded and organized into themes, and then used to elaborate and interpret quantitative findings.

Research Findings

Objective of the study sought to investigate the availability of ICT resources in primary schools in Keiyo-South Sub-County in Elgeyo-Marakwet County, Kenya and the extent to which they influenced the teachers' integration of technology in the implementation of CBC. The results of the study indicated that availability of ICT resources significantly influenced the teachers' integration of technology in the teaching and learning processes in most primary schools. It was demonstrated that the unavailability of ICT resources hindered the teachers from effectively integrating technology in their lessons. Most of the teachers indicated that electricity connectivity in the classrooms 80.1 %, digital content for grades 3 to 6, 79.4 %,and Internet connectivity 59.2 % were not available in most schools. It was also revealed that the available ICT resources were inadequate for the effective integration of technology in CBC implementation. The teachers reported that the tablets 80.1 %, desktop computers 61.0 %and laptops 42.7 % were not enough for the integration of technology, considering the high students' enrolments.

It was further observed that the available ICT resources were malfunctional due to inadequate internet connectivity which hindered the retrieval of information for teaching and learning 74.1 %and power interruptions that sometimes interfered with on-going lessons 63.0 %. Further, the study established a significant relationship between availability of ICT resources and the integration of technology in the implementation of CBC. ($r=.240;p=.000<.01$) .This showed that the teachers' integration of technology in the implementation of CBC in primary schools in Keiyo-South Sub-County was influenced by the availability of ICT resources. Effective integration of technology in the classroom was hindered by unavailability, inadequacy and the malfunctioning of ICT resources.

Conclusions and Recommendations

The study concluded that there was a positive significant relationship between availability of ICT resources and the integration of technology in the implementation of CBC in primary schools in Keiyo-South Sub-County in Elgeyo-Marakwet County, Kenya ($r=.240;p=.000<.01$) The availability of ICT resources influenced the teachers' efforts to integrate technology into the implementation of CBC. Most of the teachers did not integrate technology in their lessons efficiently because most of the ICT resources were not available (power connectivity to the classrooms 80.1 %, grades 3-6 digital content 79.4%, and Internet connectivity to ICT labs) .In addition, the ICT resources which were available were inadequate (tablets 80.1%, desktop

computers, laptops) and malfunctional due to inadequate ICT infrastructure such as limited Internet connectivity for the retrieval of information 74.1 % and unreliable electricity (power interruptions) which interfered with the teaching and learning processes. The head teachers interviewed were in agreement with these results by revealing that electricity and Internet connectivity were the common issues encountered during the integration of technology in most of the schools. They also cited financial constraints in most primary schools to facilitate their schools with adequate ICT infrastructure.

The study made the recommendations that the government should increase budgetary allocations to the Ministry of Education with the purpose of enhancing ICT resources in primary schools. Also, the board of managements of primary schools and junior secondary schools to increase their budgets for adequate ICT resources and jointly pool their financial resources to avail generators, solar panels and Internet services for the effective integration of technology in the classroom

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