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An Assessment of Digital Literacy skills on the Implementing of Competency-Based Education Among Agriculture Teachers in Public Schools in Tigania Zone, Meru County, Kenya

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Abstract: The global trends and increasing demand for twenty-first-century skills have prompted countries like Kenya to adopt a Competency-Based Education curriculum. Despite its implementation, the experiential digital needs and the absence of adequate literature on agriculture teachers at junior school level are inadequate hence calling for investigation. The current study assesses the influence of digital literacy Levels on Competency Based Education implementation. The study employed a descriptive survey research design. The target population was 295 Agriculture Teachers, and the sampling procedure was done through a multistage process at different levels: The stratified approach sampled Tigania West, Tigania Central, and Tigania East sub-counties, which constituted the Tigania Zone of Meru County. Simple random sampling technique was applied to choose the junior schools and, purposive sampling for Agriculture Teachers to participate in the study. The sample size was 169, comprising Agriculture Teachers. Data collection involved self-administered questionnaires for the Agriculture Teachers. The reliability was approximated using Cronbach's alpha coefficient at 0.81 for the questionnaire. Data was analyzed using statistical techniques with the help of the Statistical Package for the Social Sciences (SPSS) version 26.0. Quantitative data were presented using frequency distribution tables and pie chart. The finding demonstrated 40.6% of Agriculture Teachers had moderate digital literacy skills. Pearson's correlation coefficient ($r = 0.614$, $p < 0.01$) a strong positive relationship between teachers' digital literacy and their effectiveness in implementing CBE. The higher levels of digital literacy among Agriculture Teachers tend to be associated with better implementation of Competency-Based Education in junior schools. Agriculture Teachers need ongoing capacity-building in digital literacy.

Key words: Digital Literacy Skills, Competency-Based Education, Agriculture Teachers, Public Schools

1.1 Background of the Study

Competency-Based Education Curriculum is an approach of instruction emphasizing on attainment and demonstration of students capabilities including, knowledge, skills, values in addition to attitudes (Boateng *et al.*, 2023). This can be attained through pro-active, learner-centered experiences rather than routine memorization (Lim W.M, 2025). Experiential learning is a progression through which scholars constructs meaning from direct experience, reflection and application of learnt competencies (Heinrich & Green, 2020) . The preparedness of agriculture teachers entails their capacity, willingness and readiness for effective CBE implementation (Kavindi, 2014). This entails, proficient training, pedagogical content knowledge (PCK) and the aptitude to adapt to curriculum reforms. Digital literacy

in the realm of experiential learning defines the ability to use digital technologies firmly to enhance teaching-learning, and assessment process which shapes the effectiveness of curriculum implementation in Agriculture being a practical subject (Garay-Rondero *et al.*, 2019).

Education systems globally have increasingly shifted toward Competency-Based Curricula in order to equip learners with 21st-century skills demanded by dynamic labor markets and rapidly evolving technologies (Vasilescu *et al.*, 2020). Countries such as the United States have debated Competency-Based Education potential to promote equity and relevance in learning, with advocates alluding to its ability to develop both soft and hard skills essential for ultimate learning. However, variability in standards, teacher resistance to pedagogical shifts, and gaps in assessment capacity remain barriers (Anderson, 2018 Gilmanishina *et al.*, 2019). In China, scholars emphasize the need for teachers to develop competencies that integrate cross-cultural communication and experiential learning methods, particularly in technical and vocational subjects (Zhang *et al.*, 2021). Digital literacy globally emerges as a critical factor contributing to experiential learning, with most researchers citing the need for teachers to be central to digital change, bringing about blended learning environments, and apply technological tools meaningfully (Garay-Rondero *et al.*, 2019; Lim C.P *et al.*, 2020). While learners often possess basic technological familiarity, gaps in higher-order digital skills such as academic reading, writing, and collaboration in online environments persist (Parkes *et al.*, 2015). Therefore, the educator's professional digital literacy readiness remains a central factor in successful shift to CBE.

Competency-Based or Outcome-Based Education (OBE) aligned education has been adopted by several African Countries. Ethiopia's experience demonstrates that uneven resources, infrastructural limitations, and inadequate teacher training significantly constrain effective CBE implementation (Likisa, 2018). In South Africa, the shift to OBE underscored the importance of sustained teacher capacity building to develop competencies aligned with curriculum outcomes (Luckett & Shay, 2020). Similarly, Nigeria's move from Content-Based Learning to Competency-Based models highlights the need for continuous professional development and improved teacher quality (Nombo, 2022). Across the region, the integration of digital tools into experiential learning remains uneven due to infrastructural constraints, limited connectivity, and inadequate digital literacy among teachers. These regional patterns indicate that successful CBE implementation is strongly dependent on teacher digital literacy, material resources, institutional support, and a conducive technological environment.

In Kenya, curriculum reforms have progressed from the 7-4-2-3 structure at independence to the 8-4-4 system introduced in 1985, and more recently to the Competency-Based Curriculum adopted following the 2016 needs assessment study (Akala, 2021). The rollout of CBE began in 2017 at pre-primary level, with full transition expected by 2027. Since its introduction, several studies across Kenyan counties reveal that while teachers have received foundational training on CBE concepts, significant challenges remain. These include inadequate digital infrastructure, limited technological skills, and insufficient ongoing professional development (Lumonya, 2020; Koskei & Chepchumba, 2020 & Joyner, 2021)

In Meru County, similar trends have been observed, where educators continue to receive CBE-related training, yet the effectiveness of implementation is hampered by resource limitations, including inadequate access to digital tools and experiential learning facilities (Muthuri, 2023). Agriculture Teachers, in particular, bear the unique responsibility of translating experiential, practical, and field-based competencies into meaningful learning experiences, which demands strong pedagogical content knowledge, digital readiness, and hands-on expertise (Sewell, 2024).

Despite growing literature on CBE implementation in Kenya, there remains limited empirical evidence on the digital literacy levels and experiential learning readiness of Agriculture Teachers particularly in rural contexts such as the Tigania zones of Meru County. Agriculture is a practical subject heavily reliant on digital resources for climate information, modern farming technologies, simulations, and audiovisual demonstrations. Therefore, understanding the preparedness of Agriculture Teachers, the challenges they face, and the contextual factors shaping their readiness is essential for strengthening the quality of agricultural education within the CBE framework in junior schools.

1.2 Statement of the Problem

The Competency-Based Education (CBE) curriculum implementation in Public Junior Schools relies heavily on the ability of teachers to integrate experiential, learner-centered, and digitally supported instructional approaches. Although the Agriculture curriculum under CBE requires teachers to utilize digital tools such as multimedia demonstrations, online agricultural resources, and technology-based assessment platforms to enhance practical learning, many educators especially in rural areas exhibit limited digital literacy skills. This inadequacy restricts their ability to design meaningful experiential learning activities, access contemporary agricultural information, and facilitate competency development as envisioned in the curriculum. Despite ongoing national training efforts, gaps persist in teachers' digital preparedness due to insufficient professional development, inadequate technological infrastructure, and low confidence in using digital tools. Consequently, learners may not fully acquire the practical and technological competencies required in modern agriculture. Therefore, the study assesses digital literacy levels of junior school Agriculture Teachers in Tigania Zone and its influence CBE implementation.

1.3 Objective of the study

To assess the Digital Literacy Levels among Agriculture Teachers regarding the implementation of Competency-Based Education in Public Junior Schools in the Tigania Zone in Meru County, Kenya.

1.4 Hypothesis of the study

H₁: There is no statistically significant relationship between Digital Literacy Levels among Agriculture Teachers and the implementation of Competency-Based Education in Public Junior Schools in the Tigania Zone, Meru County.

1.5 Literature Review

Digital Literacy of Agriculture Teachers and Implementation of CBE

The digital literacy integration into teaching practice has become a central focus of Competency-Based Education curriculum that emphasize learner autonomy, practical engagement, and flexible knowledge application (Kumar, 2016; Falloon, 2020). Studies consistently highlights digital literacy as a critical determinant of teachers' capacity to implement digitally mediated, learner-centered pedagogies. Within agricultural education, where experiential learning and access to updated agricultural knowledge are essential, teacher digital competence not only enhances instructional effectiveness but also supports the realization of modern curriculum frameworks (Dede, 2014).

Niederhauser *et al.* (2018) conducted a multi-country study which concluded that digital literacy strongly predicts teacher engagement with project-based and competency-based instructional strategies. Teachers with advanced digital competencies more effectively implement online research tasks, digital

portfolios, and technology-supported formative assessments, contributing to improved learner performance. A significant body of research demonstrates that low digital literacy remains one of the most persistent barriers to technology integration in teaching. (Chepkemai et al., 2019) study found that while most Kenyan teachers possess basic awareness of digital technologies, their proficiency in applying digital tools for lesson design, multimedia content development, and online assessment is limited. This digital skills gap restricts teachers from adopting innovative instructional strategies that require technological mediation. Agriculture teachers in particular face additional challenges, given that their subject demands access to current agronomic information and digital simulations that model practical farm processes. This limitation substantially affects their ability to implement CBE-aligned pedagogies, which demand integration of digital demonstrations, problem-solving platforms, and experiential online resources.

Parallel findings are reported in (Muasya & Waweru, 2019) study on ICT adoption in rural schools, where the availability of ICT devices did not automatically translate into enhanced instructional practice. The authors concluded that the key predictor of digital tool utilization is teachers' level of digital competence rather than infrastructure alone. Teachers with higher digital literacy incorporated virtual demonstrations, multimedia presentations, and interactive simulations, all of which promote student engagement and skill acquisition. Conversely, teachers with low digital proficiency continued relying on traditional, teacher-centered methods, undermining opportunities for competency development. These findings underscore the argument that successful CBE implementation is grounded in teachers' ability to leverage digital tools meaningfully.

Prihartanto *et al.* (2025) established that digital tools such as virtual farm tours, e-extension platforms, and agronomic tutorials significantly improve learners' practical skills. These tools expose students to modern farming techniques and allow them to conceptualize real-world applications before engaging in hands-on activities. However, the study also noted that only a small proportion of Agriculture Teachers possess the digital literacy needed to access, evaluate, and integrate such tools. This creates disparities in experiential learning outcomes and raises concerns about the uniform implementation of CBE in Agriculture subject areas. The gap between curriculum expectations and teacher capacity highlights the need for targeted digital literacy interventions. Kigwilu & Mokoro (2022) highlighted that while teachers generally understand the philosophy behind CBE, digital competence is among the least developed areas of readiness. Teachers struggled with designing digital learning materials, navigating online repositories, and conducting technology-mediated assessments. These findings imply that without sustained professional development in digital literacy, Agriculture Teachers may not fully meet the pedagogical demands of CBE, resulting in superficial competency development among learners. The study calls for contextualized training that aligns digital literacy development with the specific instructional needs of agriculture education.

Falloon (2020) demonstrated that teachers with strong digital skills diversify instructional approaches, integrate digital simulations, and create individualized learning pathways. These practices mirror the learner-centered, practical, and performance-based strategies emphasized by CBE. Teachers lacking digital competence, by contrast, exhibit rigid instructional practices that do not facilitate competency acquisition. This evidence reinforces the notion that digital literacy is not merely a supplementary skill but a foundational requirement for any curriculum that prioritizes active learning. Otieno, (2020) identified inadequate professional development, poor ICT infrastructure, unreliable electricity, and low

teacher confidence as major hindrances to digital literacy growth in Kenyan schools. These structural and psychological barriers collectively reduce teachers' readiness to adopt digital tools, thereby weakening the implementation of digitally anchored curriculum reforms. Agriculture Teachers in rural regions are particularly affected, given their greater reliance on up-to-date technological information to teach modern farming techniques.

Overall, empirical evidence consistently demonstrates that digital literacy is integral to effective teaching and is particularly essential for implementing a curriculum that emphasizes competence, innovation, and experiential learning. For Agriculture Teachers, digital competence enables access to evolving agricultural knowledge, supports the use of digital simulations and demonstrations, and enhances learners' engagement with practical tasks. The reviewed studies reveal that while infrastructure development has improved in many contexts, teacher digital literacy remains the most critical factor affecting CBE implementation. Addressing this gap requires coordinated professional development, improved access to digital tools, and supportive school environments that encourage technology adoption. Strengthening Agriculture Teachers' digital literacy is therefore not only necessary for meeting curriculum demands but also for preparing learners to participate effectively in a modern, technologically driven agricultural sector.

1.6 Methodology

This section outlines the research design, sampling methods, data collection instruments, and data analysis techniques employed in the current study.

Research Design: The study employed a descriptive survey design, a quantitative method that is known for its capacity to gather measurable data for statistical analysis of a population sample (Nardi, 2018). The design was utilized to analyze the relationships between the experiential professional development needs of public junior school Agriculture Teachers and CBE implementation.

Location of the Study: The study was carried out in the Tigania Zone in Meru County, Kenya, which covers an area of 1542.5 Km². The Zone borders Isiolo County to the North, Buuri East Sub-County to the West, Igembe South Sub-County to the East, and Tharaka South Sub-County to the South. There are 190 public junior schools, according to information from the Meru County Education Office, each with at most two agriculture teachers. Because the Tigania Zone includes both rural and urban areas, it was deliberately selected as the research site to study how CBE is implemented in Kenya's public junior schools. Due to this diversity, examining what digital skills , Agriculture Teachers need to develop for CBE implementation can be understood in light of Kenya's main educational goals.

Target Population: The target population consisted of 295 Agriculture Teachers from all public junior schools in Tigania Zone.

Sample Size and Sampling Procedures: Tigania Zone is composed of Tigania West, Tigania Central, and Tigania East Sub-Counties in Meru County. The Zone has 295 Agriculture Teachers. Sampling was done through a multistage process at different stages. Stratified random sampling sampled the three sub counties in the Zone. Simple random sampling was applied to choose the junior schools; Agriculture teachers were selected through purposive sampling. According to Krejcie & Morgan (1970) if the target population is 295, 169 can be an adequate sample size. This guarantees that the study attains a 95%

confidence level with a 5% margin of error, which is typically acceptable for social science research. In the current study, 169 Agriculture Teachers were involved.

Research Instruments: For the collection of data from junior school Agriculture Teachers, a self-administered questionnaire was utilized for several reasons. Firstly, it enabled the researcher to efficiently gather a substantial amount of data from 169 junior school Agriculture Teachers. In this study, using questionnaires allowed us to gather detailed information about digital literacy as they are seen and understood by Agriculture Teachers. In this study, the questionnaire was divided into two sections containing information on bio data from Agriculture Teachers' and their digital literacy levels. There were both closed-ended items and Likert scale questions to gather quantitative data.

Data Analysis: Data analysis involved both descriptive statistics (frequencies, percentages, and means) and inferential statistics (Pearson's Correlation Coefficient and simple linear regression).

1.7 Study Findings

Levels of Digital Literacy in Agricultural Teachers

Table 1: Digital Literacy Levels of Agriculture Teachers

Level	Frequency	Percentage
Very Low	10	5.9%
Low	34	20.1%
Moderate	68	40.2%
High	41	24.3%
Very High	16	9.5%
Total	169	100%

Source: *Field data, 2025*

The data in Table 1 indicate the literacy levels of Agriculture Teachers in junior schools within Tigania Zone. Among the 169 respondents, 5.9% demonstrated very low digital literacy. Teachers with moderate literacy levels constituted the largest group at 40.2%, followed by those with high literacy at 24.3%. Teachers with low literacy levels made up 20.1% of the population. Finally, very high literacy competency was observed in only 9.5% of the teachers.

Digital Literacy and CBE Implementation: Pearson's Correlation

To examine the relationship between digital literacy and the implementation of CBE in Agriculture Education, a Pearson correlation analysis was conducted using responses from Agriculture Teachers in public junior schools in Tigania Zone, Meru County. The results of the analysis are presented in Table 2.

Table2: Pearson Correlation Between Digital Literacy and CBE Implementation

Variables	Digital Literacy	CBE Implementation
Digital Literacy	1.000	0.614
CBE Implementation	0.614	1.000

Source: Field data, 2025

The Pearson correlation coefficient ($r = 0.614$, $p < 0.01$) indicates a moderate to strong positive relationship between teachers' digital literacy and their effectiveness in implementing CBE. This means that higher levels of digital literacy among Agriculture Teachers tend to be associated with better implementation of Competency-Based Education in junior schools.

1.8 Conclusion

Based on the findings of the study, it can be concluded that there exists a significant and positive relationship between Agriculture Teachers' digital literacy levels and their preparedness to implement Competency-Based Education (CBE) in public junior schools within Tigania Zone, Meru County, Kenya. Both the Pearson Correlation and Regression Analyses demonstrated a strong association, indicating that Agriculture Teachers with higher digital proficiency are better positioned to implement CBE effectively in their classrooms. These findings suggest that enhancing the digital competencies of Agriculture Teachers could contribute to the effective implementation of CBE in junior schools. This is in agreement with Rahman (2024) study, which revealed that although the majority of instructors have access to technology, only 45% of them feel comfortable using it, according to a study of 100 teachers, indicating significant gaps in readiness in curriculum implementation.

1.9 Recommendations

Junior schools Agriculture Teachers' digital literacy levels should be strengthened through organized and ongoing professional development programs, the Ministry of Education, working with teacher training institutions, should give priority to improving the digital literacy of Agriculture Teachers. These training sessions should focus on the pedagogical integration of digital technologies in lesson planning, learner assessment, and interactive instructional practices in addition to covering basic ICT skills.

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