Evaluation of Teacher Practices on ICT Integration in Teaching and Learning in Lower Primary Grades in Public Primary Schools in Siaya County, Kenya

Ombese Sollome Nyaboke [1*], Benson Charles Odongo [2], Cleophas Owino Owiko [3]
[1,2,3] Department of Special Needs Education and Early Childhood Development Education, Jaramogi Oginga Odinga University of Science and Technology, Bondo, Kenya

* Corresponding Author: **Ombese Sollome Nyaboke**

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Abstract
The provision of quality education is essential for achieving Kenya's Vision 2030 and for developing globally competitive human capital. The Kenyan government recognizes that the successful realization of this goal requires the integration of Information and Communication Technologies (ICTs) in education. Even though the government of Kenya is making progressive effort towards successful integration of ICT in education there are challenges in regard to inadequate ICT infrastructure, provision of ICT equipment and little support for teachers' professional development. On this viewpoint, the current study evaluated teacher practices on integrating ICT in teaching and learning in lower primary grades in public primary schools in Siaya County, Kenya. The philosophical underpinning of this study was constructivism adopting a qualitative approach with phenomenological research design. The target population consisted of 1968 teachers of lower primary grades, 656 primary school head teachers and 1 County Quality Assurance and Standards Officer (CQASO). A sample size of 24 lower primary grade teachers, 12 head teachers and one CQASO were purposively selected to participate in the study. In-depth interview, observation protocol and document analysis guide were used to collect data. Data was thematically analyzed. The findings revealed that, there was a limited understanding of ICT integration in teaching and learning, a challenge with equality in ICT resources among public schools and that there was a lack of instructional skills among teachers necessary for the successful ICT integration in Siaya County. Therefore, the study recommended that, the government should provide strategies and mechanisms to increase ICT infrastructure and provide more ICT equipment and necessary professional support to teachers for a better outcome.

Keywords: Competency, integration, digital technology, digital literacy, ICT infrastructure

1. Introduction

The policy on Information and Communication Technology (ICT) in Education and Training (2021) recognizes that the success of Competency-Based Education (CBE) reform measures relies heavily on ICT integration to deliver quality education. Similarly, Sessional Paper No.1 of 2019 emphasizes the integration of ICT in education, training, research, management, teaching, and learning at all levels, highlighting ICT's transformative potential in education. One of the key competencies in the Competency-Based Education (CBE) is digital literacy, defined by the Kenya Institute of Curriculum Development (KICD, 2017) as the knowledge, skills, and behaviours necessary to use digital content and devices effectively and safely.
To this end, the government has made substantial investments in the education sector, both through budgetary allocations and

through initiatives led by the Ministry of Education. One such initiative is the establishment of the Information and Communication Technology in Education and Training Policy Framework, which serves as a strategic guide for implementing ICT-driven innovations aimed at enhancing education quality. ICT has now been mainstreamed across the sector, playing a vital role in both curriculum delivery and education management.

The role of the teacher is critical in ICT integration. According to Rosnain Mahmud and Mohd Arif (2008), ICT integration involves identifying where and how technology fits into teaching and learning. Teachers' practices and proficiency are fundamental to fostering digital literacy among learners. Pedo (2011) highlights that ICT serves not only as a teaching resource but also as a gateway to more resources. Brucic and Sheaver (2014) point out that 21st-century education prioritizes life and career skills, learning innovation skills, and information, media, and technology skills, all of which make digital literacy indispensable.

KICD (2017) underscores that seamless ICT integration is vital in enhancing educational experiences and preparing learners for the digital age. Exposure to digital tools equips learners with essential knowledge, skills, and behaviours for the safe and effective use of technology. Additionally, employing ICT as both a learning resource and a gateway to other educational tools fosters communication, collaboration, critical thinking, problem-solving, creativity, and learning-to-learn competencies. Responsible digital media use also promotes self-efficacy and citizenship.

Despite increased government investment in ICT, studies show that teacher practices remain a challenge. For instance, Musioma (2018) [13] reported that 67.7% of primary school teachers had below-average ICT proficiency in Siaya County, with many lacking essential technological skills. Similarly, Mosioma (2018) found that 61.3% of preschool instructors in Dagoretti, Nairobi, had no prior experience with ICT, highlighting low proficiency levels. Furthermore, the Policy Framework on ICT Integration in Education and Training (2021) identifies ICT as an enabler for 21st-century skills acquisition, advocating for inclusive ICT-enabled learning environments. However, it notes challenges such as insufficient devices relative to learner numbers and uncoordinated educator capacity development. Given this background, the study evaluated teacher practices on integrating ICT in teaching and learning in lower primary grades in public schools in Siaya County.

Reviewed literature on the teacher practises on the integration of ICT in teaching and learning reveals various gaps that can only be addressed through an empiric study. Baris and Balkas (2015) [3] examined teachers' perspectives on tablet usage in schools in Tekirdağ, Turkey, and reported negative attitudes towards tablet use, citing time loss, insufficient infrastructure, limited socialization, and classroom management challenges. Grazina *et al.* (2018) [10] explored ICT integration for experiential teaching in Lithuanian primary schools and found that teachers lacked the necessary ICT knowledge, skills, and resources to create an experiential learning environment. In Rwanda, Rwigema and Andala (2022) highlighted teachers' inadequate exposure to ICT tools and a lack of technological and pedagogical skills required for effective ICT use in classrooms. Similarly, in Kenya, Wambiri and Ndani (2016) [21, 22] discovered that lower primary school teachers felt less competent in integrating computers into their teaching. Murith and Yoo (2021) investigated ICT use in CBE implementation in Kenyan public primary schools and revealed significant barriers, including limited internet connectivity and insufficient customization of digital devices, which hindered ICT integration.

Based on the reviewed literature, there are indications that, the reviewed studies predominantly focused on ICT integration in upper primary and junior secondary levels, leaving a gap in understanding its application in lower primary grades, particularly in Early Years Education (EYE), which is foundational for future learning. Based on the reviewed literature, several research gaps have been identified. First, most studies focused solely on lesson plans, with no comprehensive evaluation of professional document planning and usage specific to Siaya County. Second, while some studies in Kenya addressed learner-centred teaching methodologies, none specifically examined their application in lower primary grades under the CBE framework in Siaya County. Third, the reviewed studies predominantly focused on ICT integration in upper primary and junior secondary levels, leaving a gap in understanding its application in lower primary grades, particularly in Early Years Education (EYE), which is foundational for future learning. Lastly, existing research on Competency-Based Assessment (CBA) concentrated on single assessment methods without exploring alternative approaches comprehensively. Overall, studies on CBE implementation provided fragmented insights, with no study exhaustively evaluating teacher practices across all aspects of CBE implementation—such as professional document planning, instructional methodologies, ICT integration, and assessment—in lower primary grades within Siaya County. This highlights the need for the current study to address these gaps.

The 2021 Policy Framework on ICT Integration in Education and Training positions technology as a key enabler of 21st-century skills and advocates for inclusive, ICT-enabled learning environments. Although the national government is making strides to overcome infrastructure shortfalls and build educators' digital capacity, critical question on how these reforms play out at the classroom level, particularly in the earliest grades remain unanswered. Lower primary grades form the bedrock of digital literacy and modern skill acquisition, yet little is known about how teachers in Siaya County conceptualize and integrate ICT into their teaching. This county not only resisted initial teacher training for the CBE rollout but also lacks empirical studies on technology integration in its public primary schools. Existing reports rely primarily on stakeholder opinions rather than on systematic, research-based evidence, leaving policymakers and practitioners without a reliable foundation for decision-making. To fill this void, the present study evaluated teacher practice on the implementation of ICT integration in lower primary classrooms in Siaya County.

2. Research methodology

2.1. Research design

This study was guided by constructivism as its philosophical foundation, utilizing a qualitative research approach with a phenomenological research design to explore and gain in-depth insights into lower primary teachers' experiences with integrating ICT in teaching and learning.

2.2. Location of the study

The study was located in Siaya County, Kenya. Siaya County, located in the Nyanza region, is one of six counties in the area. It spans approximately 2,530 km² of land and 1,005 km² of water. The county borders Busia to the northwest, Vihiga and Kakamega to the northeast, Kisumu to the southeast, and Homa Bay to the south, across the Winam Gulf.

2.3. Target population

For this study, the target population included 1,968 lower primary grade teachers, 656 primary school head teachers, and one County Quality Assurance and Standards Officer (CQASO). Specifically, it encompassed all lower primary school teachers, who serve as the primary curriculum implementers in schools, as well as all primary school head teachers, who are both educators and immediate supervisors responsible for overseeing the implementation of the Competency-Based Education (CBE) in their respective institutions. Additionally, the CQASO, as a technocrat in curriculum implementation, was a key part of the target population due to their role in ensuring quality standards in learning institutions through supporting and guiding teachers, who are the core implementers of the CBE.

2.4. Sample and sampling techniques

A total sample size of 37 participants—comprising 24 lower primary teachers, 12 headteachers, and 1 CQASO—provided valuable insights into this study. The study adopted stratified random sampling to select two public primary schools per sub-county, resulting in 12 schools overall. Saturated sampling was used to include 12 head teachers, and, with their guidance, 24 lower primary grade teachers were purposively chosen based on their CBE compliance and teaching experience.

2.5. Research instruments

In-depth interview, observation protocols and document analysis guide we used to collect data. In-depth interview for teachers of lower primary grades, primary school head teachers and in-depth interview for The County Quality Assurance and Standards Officer. Observation protocol was used to collect data from teachers of lower primary grades while document analysis guide was used to collect data from teachers of lower primary grades.

2.6. Data analysis

Collected data was analyzed thematically.

3. Results and discussion

The objective of this study was to determine how teachers integrate ICT into teaching and learning in lower primary grades. Specifically, the study aimed to explore teachers' understanding of ICT integration in education, the tools they utilize, and their experiences in incorporating these technologies into their teaching practices.

To achieve this objective, data was collected through in-depth interviews, document analysis, and observation protocols. After coding the data from these three instruments, three key themes emerged: inadequate understanding of ICT integration in education, limited and inequitable access to ICT tools, and low self-efficacy in using computers among teachers.

3.1. Inadequate Understanding of ICT integration in Education

After analyzing the collected data, a recurring theme emerged: the inadequate understanding of ICT integration among teachers. The responses provided by informants revealed varied levels of comprehension, with some offering partial definitions that captured only fragments of the concept, while others completely missed its essence. To explore this theme further, the discussion was guided by the primary question: "What do you understand by ICT integration in education?" Using in-depth interviews, informants shared diverse perspectives, which are outlined below. One informant notably explained.

ICT integration means using devices like mobile phones, tablets, laptops or even computers to teach learners. Using the devices to download more information..(IILPGT4).

Another teacher confidently added that,

ICT integration is the use of ICT tools to teach by downloading more information on the topic you want to teach…. Yes we use them to get missing information from the course books as this enriches teaching and learning or to get more explanations on a given strand……..(IILPGT6).

Another teacher noted that,

ICT integration is the use of ICT devices to enhance the teaching and learning experiences by searching and downloading more information about the strand or sub-strand one is teaching. Teachers can teach learners more about various ICT devices and how to use them to access more information for learning purposes and in helping the learners develop digital literacy skills….(IILPGT10).

A head teacher had this to say,

It means teachers using devices to promote teaching and learning process during lessons at the same time teaching learners about these devices so that they can use them to learn more on their own or with the help of other learner or parents from the internet while out of school……. (IIPSHT3)

Another head teacher elaborated that,

It means using various devices in teaching and learning whereby, the teacher can access more information from the internet. The learners can also be exposed to these devices too so that they know get to know them well and be able to use them responsively …. (IIPSHT6)

The theme of inadequate understanding of ICT integrations was also revealed more when teachers were asked to share which ICT devices and how they use them in teaching and learning. This question sought to explore the various ways teachers use various devices in class.

One teacher shared,

In most cases I use my phone to download more information using the links given in the course books and you realize with CBE, most books are so shallow so I google for more content….(IILPGT1).

Another teacher added that.

I sometimes use my phone to google more information that I need when teaching a given learning area. For example, when am teaching hygiene and nutrition, I download information on how a certain skill is performed and I show the learners to make them understand better…. (IILPGT2).

A teacher said that,

I used to use tablets to download any information I wanted to depending on what am teaching or show pictures of things that I want the learners to see…unfortunately for two terms

now we do not have power. The transformer has issues….it is not working……(IILPGT7).

Another informant concluded that,

I do not use any device as such because ICT integration in this school is not taking place at all. There is no power and this is my second year here but I have never seen tablets. Maybe they are kept somewhere……..(IIPGT9).

When the same question was asked the head teachers, one of them had the following to share,

Sometimes teachers use their mobile phones in downloading information using the links given in the course books and in some books like social studies, they are too shallow, so teachers goggle more information on a given topic before teaching. …(IIPSHT2)

Another head teacher added that,

Occasionally, teachers come for tablets while others use their phones when they needs get more information on the topic they are handling…so they use them enrich their lessons….(IIPSHT5).

Another head teacher had the following to share,

At times, you can see a teacher coming to ask for the tablets whenever they need them and some teachers use their mobile phones. They use them for downloading more content for their respective teaching learning areas….(IIPSHT7).

The excerpts highlight a diverse understanding among educators regarding ICT integration in teaching and learning. Most teachers seem to associate ICT integration with using devices to access and download supplementary content for enhancing lesson delivery. This perspective reflects a functional view of technology as a tool for enriching their teaching materials with additional information. However, some educators exhibit a deeper comprehension of ICT integration.

For instance, one teacher (IIPGT10) interprets ICT integration as a means to enhance teaching and learning experiences by leveraging devices to access subject-specific information. Furthermore, this teacher emphasizes the importance of developing learners' digital literacy skills, demonstrating a forward-looking approach that prepares students for the digital world. Similarly, a headteacher (IIPSHT3) underscores the role of ICT integration in facilitating learning and enabling students to use devices independently at home, with support from parents or guardians. This perspective expands the application of ICT beyond the classroom and fosters self-directed learning, bridging the gap between school and home environments.

In terms of the devices used by teachers, mobile phones and tablets emerge as the most commonly utilized tools. These devices are valued for their accessibility, portability, and versatility, making them suitable for various educational purposes. However, challenges in ICT integration persist. A segment of teachers reports that ICT usage is absent in their respective schools, citing the lack of devices and infrastructural support as key barriers. Field notes corroborate these findings, indicating that ICT adoption among educators varies significantly. Factors contributing to these disparities may include limited access to technology, insufficient training, or a lack of institutional support and confidence in using ICT effectively.

These observations reveal both opportunities and challenges in ICT integration. Teachers with a strong understanding of ICT's potential have the opportunity to innovate and transform teaching and learning processes. They can explore creative ways to utilize technology in the classroom, aligning with broader educational goals. Conversely, for teachers struggling with ICT adoption, targeted interventions such as professional development programs, access to infrastructure, and ongoing support are essential to address these challenges. Overall, the excerpts underscore the importance of fostering a shared understanding of ICT integration among educators while addressing the barriers that hinder widespread adoption.

More data through field notes asserted the findings above on teacher understanding of ICT integration in education.

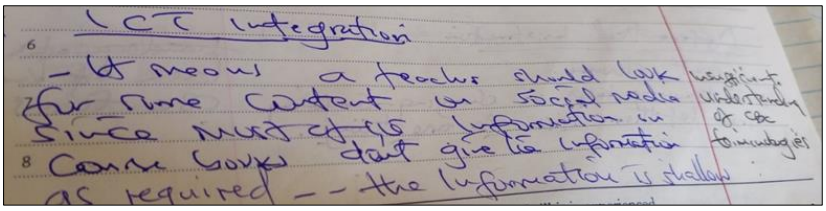

Fig 1: A section of field notes during interviews with teachers of lower primary grades.

Figures 1 through 6 offer a comprehensive glimpse into the understanding and practice of ICT integration and the Competency-Based Education (CBE) among educators in lower primary grades in Siaya County. Figure 4.3.14 highlights interviews with lower primary teachers, one of whom described ICT integration as merely accessing additional teaching content using phones or tablets. This view reflects a surface-level understanding, which limits the potential of ICT as a transformative educational tool.

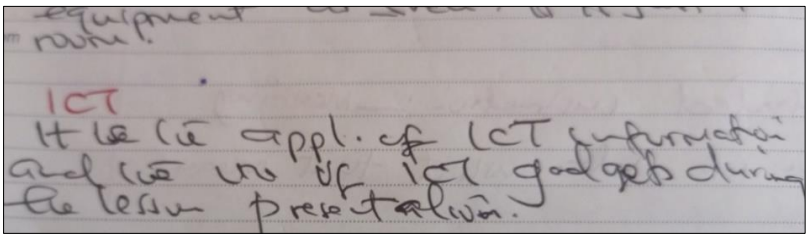

Fig 2: A section of field notes during interviews with teachers of lower primary grades.

Figure 2 reveals another teacher's perception of CBE as simply involving the use of ICT gadgets during lessons, underscoring a narrow interpretation of its broader objectives.

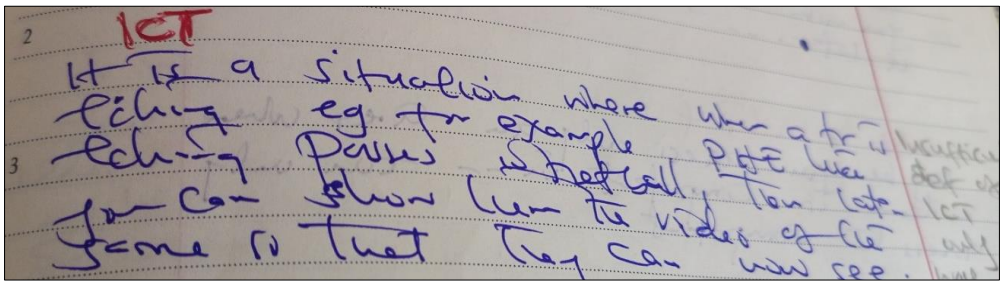

Fig 3: An extract from field notes during interviews with head teachers

In Figure 3, interviews with head teachers further emphasize a restricted view of ICT integration, focusing primarily on enhancing instruction without considering its role in fostering essential skills and values among learners. Figure 4.3.19 provides a striking example of a mathematics lesson plan that demonstrates a lack of clarity regarding CBE terminologies. The absence of a proper understanding of competencies-core to CBE-signals significant challenges in implementing the curriculum effectively. This inadequacy reflects a systemic issue that may impact the educational outcomes of lower primary learners.

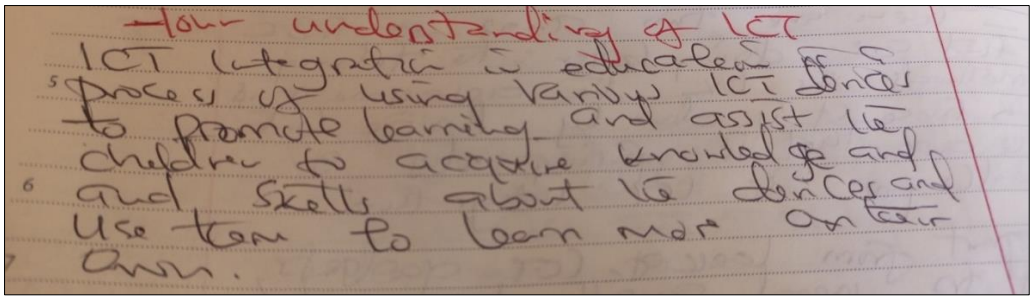

Fig 4: A section of field notes during interviews with teachers of lower primary grades

Figure 4 presents a more encouraging perspective from lower primary teachers who attempted to define ICT integration as a process of using various devices to promote learning. These teachers emphasized equipping learners with knowledge and skills to operate tools and use them for further learning. While this definition is more aligned with the Ministry of Education's guidelines, it remains incomplete in addressing all aspects of ICT integration.

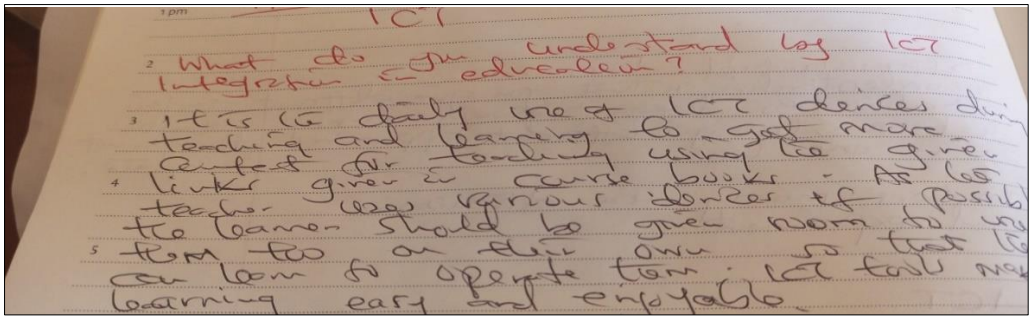

Fig 5: A section of field notes from interviews with teachers of lower primary grades.

Figure 5 shows head teachers' emphasis on the role of ICT in accessing additional information. They highlighted how links provided in course books help learners develop digital literacy, a critical competency in modern education. However, the interviews reveal that only 30% of the 22 educators demonstrated a fair understanding of ICT integration in education. This is alarmingly low and raises concerns about the effective adoption of ICT practices in lower primary schools. The Ministry of Education (2021) [14] defines ICT integration as the seamless incorporation of information technologies to support curriculum objectives. This includes developing competencies such as skills, knowledge, attitudes, and values, alongside managing education more effectively. Unfortunately, the majority of educators interviewed offered partial definitions, focusing primarily on enhancing instruction while neglecting the critical components of fostering digital literacy skills and instilling values in learners.

The limited understanding of ICT integration among educators is a clear indication of compromised knowledge and practice of the CBE. Pedagogical practices are a reflection of educators' knowledge, beliefs, and understanding, and this gap is likely to result in suboptimal implementation. These findings align with Akala's (2021) [1] research in Kenya, which revealed that teachers often possess vague knowledge of CBE and are ill-prepared for its

implementation. Addressing these gaps through targeted professional development and support will be crucial in ensuring effective ICT integration and the successful realization of CBE objectives in Siaya County.

3.2. Lack of Equality and Equitable Access to ICT tools

Ensuring equality in the provision of ICT tools is critical for creating equal opportunities among learners when integrating technology into teaching and learning. Such equality fosters positive educational outcomes by allowing all students to engage meaningfully. Equitable access to ICT tools goes a step further by addressing the unique needs of learners who may require additional attention and support, ensuring that no student is left behind. It emphasizes the importance of tailoring opportunities to accommodate diverse circumstances and challenges. To understand these issues more deeply, a key question was posed during the study: "How do you experience integrating ICT in education?" This question, complemented by follow-up probes, was presented to three categories of informants to gather diverse perspectives. The responses revealed practical challenges faced by educators, who often struggle to incorporate ICT into their teaching methods due to insufficient resources and infrastructure.

One teacher opined that,

I have a little challenge now that I always use my phone to Google information but the phone is too small to serve 56 learners. When I want the learners to have a look at a picture or see how a certain skill is performed during creative activity area, I have to go round the class holding up the phone moving closer to ensure that they at least see something. It is both hectic and time consuming. l I need a projector to make the screen big enough for learners to see or enough tablets to serve them in groups. …IILPGT 1).

Another teacher disclosed that,

We have tablets but they are kept in their boxes the way they were brought to school. whenever any of us asks for them the head teacher will always say, 'mwalimu those things are not working'… so i use my phone to download the information through the links in text books.(IILPGT.3)

Another teacher of lower primary grades reiterated that.

Integrating ICT in teaching and learning needs bundles and it is upon the teacher to buy. But you see, a teacher handles other learning areas in different streams and all the learning areas have provided links for downloading more information almost daily. This can show you how much bundles one needs…it is a lot. This is possible with internet connections in school or teacher getting support from the school, which is not the case here. This makes it difficult to integrate ICT as much as I would like to….(IILPGT4)

Another informant briefly remarked that,

We do not have power in my school, so the ICT integration in teaching and learning in the whole school is not taking place at all. I simply teach and ask the learners to use the provided links to learn more using their parents' mobile phones while at home.…(IILPGT6)

A teacher looking disappointed shared that,

The experience is not pleasant when it comes to ICT integration in teaching and learning especially in my current station. Of course, we have electricity in the school and a few tablets which can be shared by learners in groups but the problem is getting them when you need them. Well, you see sometimes i plan to use the few available tablets but when I go to request for them from the administration you are told they have been taken by another teacher and you are put on the waiting list or given one or two to use in your class. Or better still I can be given one tablet against47 learners in grade one for a lesson lasting 30 minutes….. When this happens, the lesson will not go on as planned. So by the end of the day there is so integration taking place…. (IILPGT7).

A teacher added that,

It is not easy my dear, I doubt we have any working tablet in this school. All I hear is that these things are not in working condition colleagues and they need some repair, which is yet to be done according to the administration. I don't even bother looking for them……i use my phone where I can but the challenge is that the cost of bundles is on the teacher….(IILPGT9).

Another teacher concluded that,

ICT integration in my schools is going on but not as ought to be. We have a few tablets in good condition. A laptop and a projector. During education day, some parents donated two desktops to the school. Even though not new, they are in working conditions. So, whenever a teacher wants to use the devices, you inform the administration early and if they are available during your lesson then you can use them. Power supply is fairly good and the school supports us with bundles occasionally to ensure that digital literacy is promoted in the school……(IIPGT11)

When the same question was asked to the head teachers and the quality assurance officer they gave the following responses,

One head teacher said that,

To be honest, ICT integration in this school is very minimal due to various challenges. For example, laptops and tablets brought by the government many of them have broken down. The working tablets are only seven against the population of over one thousand learners in the whole school. Some teachers care to use them but unfortunately, we experience constant power blackouts……(IIPSHT9).

Another head teacher echoed the same by adding that,

Even though ICT integration can be seen in the schemes of work and lesson plans, unfortunately it is not the case when it comes to the actual teaching in class. Teachers face many challenges. The devices are not enough, there is no power right now as we speak the transformer serving this area is not working for five months now when it comes to actual teaching, the teacher will definitely fail to implement the lesson as planned…. (IILPGT4

Another head teacher noted that,

ICT integration in this school is far from being realized. I was transferred here last term and the report I was given is that, school was broken into sometime back and the projector and laptop were stolen. Even though there are tablets, some are of them are not in working condition; they are not charging. The few in good condition are indeed few to be used by teachers as they would wish……(IIPSHT5).

The quality assurance and standards officer shared that,

ICT integration is very far from being realized more so in the very remote schools. For the schools in towns and its environs the case is a bit different. Some schools in towns have stable power supply, internet connectivity and I think the teachers are more committed to promote digital literacy through ICT integration. On the other hand, schools from remote places of the county experience quite a number of challenges. Some schools are connected with electricity but the power supply is very unstable. Some schools have as little as six working tablets in a population of more than 500.

Therefore, there is very minimal ICT integration going on in these schools….(IICQASO)

The excerpts above highlight a significant disparity in infrastructure and access to ICT tools among schools in Siaya County. Many schools face either a complete lack of infrastructure or severely limited resources, resulting in unequal opportunities for both teachers and learners to access and utilize ICT. This disparity underscores the failure to adapt opportunities to accommodate the diversity present within classrooms.

For instance, it is evident from the discussions that only a limited number of tablets are functional in certain schools, while many others are broken or unusable. This situation has left numerous schools stranded in their efforts to integrate ICT into teaching and learning processes. Additionally, findings reveal that many schools in Siaya County lack a reliable power supply and are not connected to the internet. These challenges serve as clear indicators that ICT integration in education is progressing at a minimal pace, if at all.

Nevertheless, some positive findings emerged. In certain schools, administrators actively support teachers in their attempts to integrate ICT into their classrooms. Schools located in urban areas, for example, enjoy a consistent power supply and a more conducive environment for ICT adoption in teaching and learning activities.

Furthermore, field notes gathered from interviews, lesson observations, and document analysis reinforce the conclusions drawn from earlier discussions. These data emphasize the inequities in access to ICT tools and opportunities for their use, affecting both teachers and learners alike.

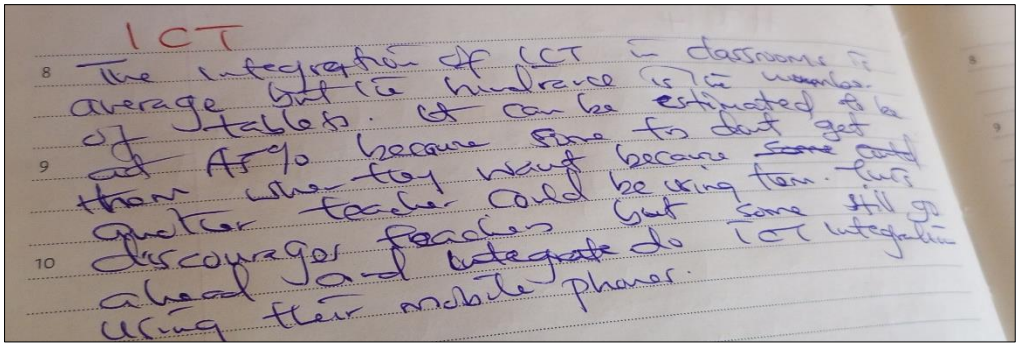

Fig 6: A section of field notes during interviews with head teachers on equity and access.

Figure 6 presents a section of field notes gathered during interviews with head teachers on the equitable access to ICT tools for both learners and teachers. It reveals that the primary obstacle to ICT integration is the scarcity of functional tablets in relation to the high student enrolment. This situation not only limits access but also discourages teachers from utilizing ICT in their teaching.

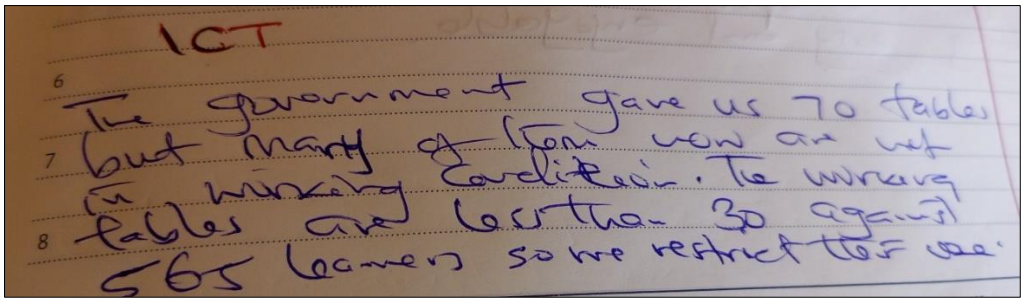

Fig 7: A section of field notes during interviews with head teachers on equity and access.

Figure 7, an extract from field notes during interviews, confirms this issue. For instance, one school initially received 70 tablets; however, only 30 are currently operational, serving 565 learners. This translates to a student-to-tablet ratio of 1:19, which significantly restricts access and usage. Due to the limited number of devices, their utilization is rationed, allowing only a few teachers to incorporate ICT at any given time.

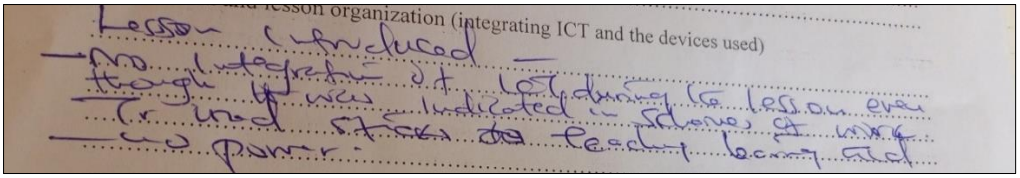

Fig 8: An extract from a lesson plan protocol on ICT integration in actual teaching

Figure 8, derived from a lesson observation protocol, indicates that despite ICT being included in the schemes of work, teachers did not integrate it into the actual teaching process. Observations revealed that none of the five teachers whose professional documents incorporated ICT made attempts to use it during their lessons. Teachers cited various reasons for this, including claims that specific strands did not require ICT use in class but were better suited for extended work or homework assignments.

Additional data collected from field notes, interviews, observations, and document analysis further demonstrated that ICT integration rarely materialized during actual teaching, despite its inclusion in professional documents. This gap can be attributed to the lack of a supportive environment for ICT use in classrooms.

In lower primary grades across Siaya County, sustainable and equitable access to ICT tools by both teachers and learners remains unrealized. For example, many teachers rely on mobile phones, which are unsuitable for large classes and fail to address diverse student needs. Learners with mild visual impairments may require projectors, while those seated far back or with hearing impairments are often disadvantaged. This raises significant equity concerns.

Data reveals that equality in ICT resources has not been achieved in Siaya County. Schools located in urban areas, attended largely by students from well-off families, have access to more ICT tools compared to schools in rural settings, where the majority of families face financial hardships. This disparity creates an unequal playing field, leaving rural schools with limited access to ICT resources and technologies, such as software tools and digital infrastructure. Teachers and learners in these schools face significant challenges in acquiring and utilizing ICT tools for teaching and learning, which restricts their ability to integrate technology effectively into education.

Evidence from the excerpts confirms the magnitude of this challenge, with some schools reporting learner-to-tablet ratios as high as 59:1, 25:1, and even 95:1. These findings suggest that while teachers may intend to integrate ICT into their teaching, numerous barriers hinder these efforts. Key obstacles include unreliable electricity, poor internet connectivity, and an inadequate supply of functional devices. The findings align with a study conducted in Rwanda by Harerimana and Mthali (2018), which identified challenges faced by educators in resource-limited settings, such as inadequate access to ICT hardware, software, and internet connectivity. Similarly, Kenya's needs assessment report for the development of ICT policy in education and training (2018) highlights inadequate equipment, poor internet connectivity, and unreliable power supply as major challenges to ICT integration in education.

Additionally, Cheruiyot (2024) [5] observed that limited resources, including digital tools and insufficient infrastructure, hinder the implementation of the Competency-Based Education (CBE), particularly in rural and marginalized areas. Laranjeiro (2023) [12] also emphasized that the availability and accessibility of technological tools in classrooms are critical determinants of effective ICT integration. If technology is not readily available or accessible to learners, its potential remains unrealized.

3.3. Low computer self-efficacy among teachers

The theme of low computer self-efficacy in ICT integration among teachers consistently emerged during interviews and observations, highlighting a recurring challenge in the education sector. In this context, self-efficacy refers to the combination of knowledge, skills, and attitudes required by teachers to successfully and efficiently incorporate ICT into educational practices. It encompasses their confidence in navigating digital tools, adapting them to instructional needs, and overcoming related challenges.

To explore this issue further, the discussion was guided by the key question, "What is your experience with ICT integration?" This question, along with related probes, elicited varied responses from informants, shedding light on their experiences, perceptions, and practices regarding ICT integration in teaching. The responses revealed not only the barriers they encounter but also their level of comfort, confidence, and adaptability in utilizing ICT tools.

One of the informants noted that,

I have been teaching for ages without using any of these devices so far. The new changes in teaching with computer technology is good but I don't have what it takes to use them and furthermore, I only have a few years to retire so I don't see the need of going for training. Let the young teachers in the profession take the task……(IILPGT.3)

Another teacher said,

I am only comfortable using my phone to get more information because books are so shallow. About using tablets and computers am not sure how to go about them so I shy off because I don't want embarrassments before learner now that one day, I experienced it when I failed to adjust an image on a tablet…. I think there is need for some technical support and in-service courses for teachers on ICT integration in teaching and learning….(IILPGT 7)

Another interjected,

I do not think I can use the tablets or computer in teaching. I am not comfortable without any technical support. Last term my colleague and I got embarrassed when projecting a lesson that failed before the learners. I am yet to undergo any ICT training to enable me use these devices for teaching comfortably.…(.(IILPGT11)

Another teacher firmly said that,

Technology found me teaching, am still teaching without them because I do not have the required skills. If the government wants us to use them then they should make sure we are all trained…(IILPGT12)

One of the head teachers briefly said that,

Here we have a problem, some teachers are no even ICT compliant and this is a real problem that must be addressed for ICT integration to kick off. For sure, the cases of having teachers who are not ICT compliant is rampant more so in schools in remote areas like this one. A teacher cannot teach learners what they don't know themselves. This hinders teachers from using even the few available tablets….(IIPSHT..3).

Another head teacher added that

ICT integration among my teachers has a serious problem to be honest. Teachers do not seem ok with integrating ICT in teaching and learning even when the tablets are free and available. You can literally see a teacher avoiding the use of tablets. Some training on how to integrated ICT in teaching and learning is necessary….(IIPSHT5)

Another head teacher asserted that,

You find teacher's comfortably using mobile phones even computer for personal things but not for instructional purposes. Therefore, there is need to train all teachers on how to use ICT devices for instructional purposes and to promote digital literacy among learners during teaching and learning. Due to lack of this, some teachers simply use the tablets to get more information but leave out the element of developing digital literacy due to ignorance…. (IIPSHT 7)

Another head teacher observed that,

Teachers do not do any ICT integration in class. When I ask some of them they say there is no time and that they will integrate later….they seem reluctant and think mainly because of negative attitude and the lack of knowledge and skills in integration ICT….(IIPSHT8).

Findings from in-depth interviews reveal that teachers generally hold a negative attitude toward the integration of ICT in teaching and learning. Many educators feel that ICT is unnecessary, believing that effective learning can still occur without technology. This perception indicates a lack of understanding about the rationale behind the Competency-Based Education (CBE) and the importance of developing digital literacy among 21st-century learners.

Furthermore, the interviews highlighted that teacher often feel uncomfortable using ICT devices, primarily due to fear of failure, leading to frequent requests for technical support. This reluctance stems from a lack of the required knowledge and skills for instructional purposes. Although some teachers may have basic ICT competencies for personal use, they typically lack the specialized expertise needed to integrate ICT effectively into their teaching practices. These findings align with Mula's (2021) [15] observation that teachers exhibit low ICT literacy levels and moderately positive attitudes toward ICT integration. Jackson (2023) also noted that professional development opportunities, such as workshops and training sessions, play a crucial role in equipping teachers with the skills and confidence necessary to use technology effectively in the classroom.

Lesson observations further reinforce these findings. Although some teachers had schemes of work and lesson plans that incorporated ICT devices, none of the observed teachers utilized these devices during their lessons. For instance, LOP3 admitted to being unfamiliar with tablets and planned to seek assistance later from a colleague teaching in junior school. Similarly, LOP5 included the use of a laptop in their lesson plan for accessing additional data during an integrated science lesson but did not use it, citing concerns about teaching time and postponing its use.

LOP8, who intended to use tablets in a Christian Religious Education (CRE) lesson, was unable to do so due to prolonged power outages that left the devices uncharged. LOP10, during a mathematics lesson, explained that the current lesson did not require ICT devices, although students were expected to use them later for homework and extended activities. Additionally, teachers were often observed assigning ICT-based tasks for learners to complete at home, requiring them to use their parents' mobile phones for researching sub-strands and completing assignments. This reliance on learners' access to technology outside the classroom further underscores the gaps in direct ICT integration during lessons.

In summary, the data highlights that limited ICT literacy, fear of failure, and logistical challenges hinder effective ICT integration among teachers. To address these issues, professional development and consistent technical support could help educators align their practices with the demands of modern digital literacy and the CBE framework.

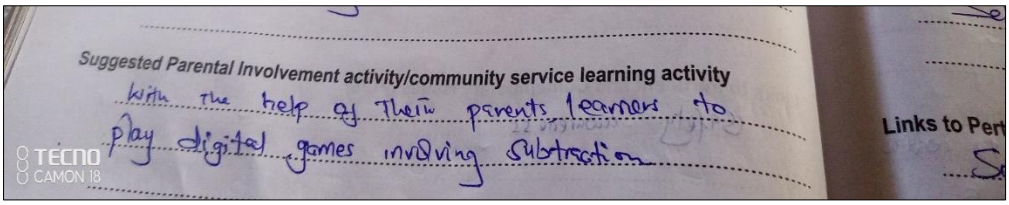

Fig 9: A section of a lesson plan on ICT integration

From Figure 9, it is evident that a section of the lesson plan indicated that ICT integration during the lesson was limited to extended work at home, emphasizing parental involvement. A segment of downloaded schemes of work showed well-incorporated ICT devices. However, during actual teaching, no ICT integration occurred. Similarly, some learners displayed a handwritten scheme of work where teaching and learning resources did not feature any elements of ICT integration.

These observations reveal that, among the 50% of teachers with prepared schemes of work and lesson plans, none integrated ICT into their lessons. Notably, downloaded schemes of work demonstrated thoughtful ICT inclusion, while handwritten schemes of work lacked any mention of ICT integration.

This disparity suggests that the willingness or motivation among teachers to integrate ICT into teaching and learning is either entirely absent or significantly low.

The excerpts further highlight the reluctance of teachers to embrace ICT integration in the classroom. A lack of instructional skills necessary to use ICT tools for teaching purposes is evident. While some teachers have acquired basic computer operational skills, they lack the confidence and expertise required for instructional applications. For example, some informants appeared unsure of how to effectively use tablets or computers in their teaching. UNESCO (2011) supports these findings, asserting that the successful integration of ICT into the learning environment hinges on teachers' ability to restructure learning approaches.

This includes merging technology appropriately with pedagogy, fostering socially active classrooms, and encouraging cooperative and collaborative group work. Such integration requires a unique set of skills that many teachers currently do not possess.

The findings align with the study conducted by Rwigema and Andala (2022) in Rwanda, which revealed that teachers with limited exposure to ICT tools lacked the necessary technological knowledge and skills for classroom use. Similarly, Nelsy (2023) [18] found that teachers' attitudes and beliefs about technology significantly impact how it is utilized in classrooms and that teachers who are hesitant or resistant to adopting technology are less likely to incorporate ICT in teaching or may use it ineffectively, hindering learning outcomes.

Conclusion

The study found that the majority of teachers in Siaya County lacked a comprehensive understanding of ICT integration in education. While 73% of the interviewed teachers demonstrated partial knowledge, their perception of ICT integration was largely confined to its role in supporting and enhancing classroom instruction. However, the broader aspect of ICT as a tool for developing core competencies—such as digital literacy—was often overlooked.

Further findings indicated that, despite teachers showing a genuine interest in integrating ICT into teaching and learning, they faced significant challenges related to equality and equity in accessing ICT tools. Many schools lacked essential digital infrastructure, such as computers, tablets, and laptops, leading to disparities among learners. The limited availability of software tools and internet connectivity contributed to an access divide, creating inequalities in ICT adoption and use across different classrooms and schools.

Although 60% of teachers incorporated ICT devices in their lesson plans, actual classroom observations showed that only 30% implemented ICT integration using tablets and mobile phones. Additionally, many lower primary grade teachers exhibited low computer self-efficacy, meaning they lacked confidence in using digital devices for instructional purposes. This was further compounded by negative attitudes toward technology and insufficient training on effective ICT use in education. Some teachers were uncertain about their ability to incorporate ICT into their lessons, which hindered meaningful technology integration in learning activities.

Overall, only 40% of the observed lessons attempted to integrate ICT, with half of these (20%) utilizing the few available tablets, while the remaining 20% relied on mobile phones. This suggests that ICT adoption in teaching and learning remains limited due to inadequate digital infrastructure, gaps in teacher training, and a lack of awareness about the broader educational benefits of ICT beyond classroom instruction.

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