



WHERE ARE WE IN SPACE: EXAMINING TEACHERS' ICT COMPETENCY IN TEACHING LEARNERS IN SPECIAL SCHOOLS IN KENYA

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Abstract:

Information Communication Technology (ICT) plays a central role in facilitating education in the 21st century. For successful integration of ICT in teaching and learning teachers play a key role. As such, there is a need for competent teachers in applying ICT skills to teach and facilitate learning. This study sought to examine teachers' ICT competency in implementing Digital Literacy Programme (DLP) in public primary special schools in Nairobi County ii Kenya. The study used a semi-structured questionnaire tool to collect data from 99 teachers and 41 head teachers from public primary special schools in Nairobi County. Mixed-Methods Research (MMR) where both Statistical Methods and thematic analysis approaches were used to analyse the data. Statistical Methods used include descriptive analysis such as frequencies and percentages and bivariate analysis approaches including Chi-square tests of hypothesis regarding the relationship between teacher's ICT competency and implementation of DLP. The study found that the role played by DLP in building teacher ICT skill capacity is 28.4% lower in special schools compared to regular schools. As a result, teachers of children with disabilities and special educational needs have limited relevant ICT skills such as assistive technology to support teaching and learning. The study also found that whilst there may be a significant proportion of teachers skilled with ICT skills, lack of access to digital devices and internet connectivity makes it difficult for them to demonstrate their competency and apply the same to the teaching of children with disabilities. Based on the results of this study, recommendations for policy enhancement and improvement of practice have been made.

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1. Introduction

Information Communication Technology (ICT) plays a central role in facilitating education in the 21st century. Global development blueprints such as the Sustainable Development Goals (SDGs) underscore the role of ICT in facilitating lifelong learning. These trends have influenced education reforms around the world including in Kenya. The Competency-Based Curriculum (CBC) being among the latest education reforms in Kenya identifies digital skills as critical in the 21st century era. The government recognizes ICT as a fundamental component of its society, as well as the vital role that ICTs play in improving education and development. The government asserted in its Master Plan 2008-2012 that achieving Vision 2030 would be difficult without utilizing ICTs (Kamau, 2014). Successful integration of ICT in the teaching and learning process demands that teachers be competent in ICT skills. This makes teachers efficiently facilitate the learning process as it is envisaged by the Competence-Based Curriculum (CBC) framework. The CBC framework requires teachers to re-invent their roles to adopt the facilitative one in learning and teaching. To effectively adopt this role, it is necessary for teachers to understand the principles of ICT as a means of accepting and integrating technology into their pedagogy.

In response to equipping teachers with ICT competencies, the government of Kenya 2013 started a robust program described as the Digital Literacy Programme (DLP). The DLP had many components including teacher capacity building, device assembling, and distribution, and internet connectivity. The goal was to integrate ICT into the teaching and learning process. The full application of ICT alongside other education initiatives is expected to meet important issues such as access, quality, equity, technology, and innovation in Vision 2030. Leveraging ICTs such as assistive technology may also play a role in enhancing the inclusion of children with disabilities.

The DLP targeted the distribution of digital devices in all public primary schools and train all teachers to efficiently use the devices. Some of the devices distributed by the DLP include laptops, projectors, and tablets among others. These learning environments include technologies that make contemporary, media-rich digital content more accessible while also embracing a flexible teaching and learning process. Integrating ICT into special needs education would be a game-changing tool for addressing our society's handicapping challenges. It is important to note that technology integration in primary special schools is vital. The ability of primary school teachers and education management to properly utilize the power of technology to boost student learning is critical to the DLP's success.

Technology plays an important role in the teaching of students with disabilities and special needs thus expanding inclusive education opportunities. Despite the hope that ICT brings to the teaching of children with disabilities and special educational needs, most special education programmes in Kenya appear to be using old-fashioned braille

machines, typewriters, traditional teaching methods, and chalkboards in their teaching and learning, instead of the modern devices such as Orbit readers and ePUBs (Nwana, Ofoegbu, & Egbe 2017). Whilst there may be many factors contributing to this situation, the scope of this study is teachers' ICT competency. This scope is based on the idea that the teacher is an agent of change, as a result, their competency level may determine the extent to which ICT is integrated into the teaching and learning process. It is against this backdrop that this study was conducted.

2. Literature Review

The competence of teachers in the ICT sector is a worldwide concern as well as that of many other professionals. Examples include teachers' skills in the use of ICT administration, preparation for teaching, proficiency in ICT tools, and ICT literacy. The European Union (EU) recognizes the shortage of skilled ICT manpower and hundreds of thousands of ICT-related job positions as a problem and has launched the Digital Work Alliance big 2021-2024.

What might it entail to gain digital teaching skills? While this would necessitate additional research, Pozos and Tejada (2018) propose competency integration, in which digital competence is incorporated into specific teacher competencies to integrate appropriately into the repertory of actions performed by university teachers. A path that involves various sophisticated cognitive processes in which the most relevant technology systems are located, studied, structured, assessed, and critically selected to solve a pedagogical problem.

Teachers are at the heart of the education system and therefore have an important role in integrating ICT into teaching and learning (Tekya & Asare, 2016). According to Bhattacharjee and Deb (2016), teachers must be able to structure their learning environment in non-traditional ways in order to successfully integrate ICT into teaching and learning. As a result, teachers who are inexperienced with technology will limit their creativity and confidence when using it in the classroom. In addition, teachers' ability to integrate technology into classroom activities and appreciate the versatility of technology as an important teaching and learning tool depends on their knowledge and ability to apply ICT on their own (Kamaruddin, Abdulla, Idris, and Nawawi, 2017). This means that building teachers' capacity for ICT literacy, as well as an ongoing practice, is essential for effectively integrating ICT in the classroom. Teachers must be prepared to use technology in providing essential knowledge as the world becomes increasingly digital and virtual classrooms become more pervasive. It is not surprising that the topic of teacher competence in the field of ICT has aroused the interest of many researchers around the world.

Cui (2015) acknowledges that technological innovation has increased the pressure on teachers to use various types of technology tools in the preparation and delivery of 21st century teaching. However, if teachers lack the necessary knowledge, ability, and spirit to incorporate technology into their teaching and learning processes, technology

will not be fully utilized. Teachers must constantly adapt to new technologies and enhance their knowledge, skills, and competencies to be able to incorporate technology into their classrooms for efficient and successful teaching.

Teachers with pedagogical expertise who are ready and willing to convey knowledge while also assisting learners in their knowledge construction will typically make a difference in any learning process. When teachers have little or no knowledge of ICT, as most do, the integration of ICT into instructional practices is severely hampered (Boakye & Banini, 2008). Therefore, the preparation, attitude, knowledge and skills of special education teachers in teaching learners with disabilities are very important in our time (Leslie & Paul, 2003).

Providing ICT tools in special schools without building teacher capacity will not improve ICT integration in special schools. This could be another futile exercise on the part of the government. In this regard, it is necessary to help teachers acquire skills so that they can contribute to the integration of ICT in schools. Teachers' expertise and willingness to accept ICT are typically linked to sociological characteristics such as age and previous teaching experience with ICT (Cox & Marshall, 2007). They also discovered that teachers' pedagogical approaches may influence whether ICTs can be integrated into the teaching and learning process. If a teacher believes in and uses traditional teaching methods, he or she is unlikely to adopt his or her pedagogy to incorporate ICT into teaching and learning. If a teacher believes and uses traditional teaching methods, it is difficult for them to apply their pedagogy to integrate IT into teaching and learning. Teachers' readiness to integrate technology into their teaching has evolved in many ways, including school readiness, resource availability, and teacher skill development. (Bonanno, 2011).

The ability of teachers to use ICT infrastructure for instruction is critical to the successful implementation of ICT in education. Similarly, if teachers have ICT skills and are confident in their abilities, they will frequently use ICTs in their teaching activities (Faisal et al., 2017). In a related study, DuPlessis and Webb (2012) claimed that teachers are the ones who are most affected by technological changes and that their readiness to meet the new needs for curriculum implementation will determine whether the process succeeds or fails.

Mwakyjeja (2013) investigated teachers' knowledge and how they use Assistive Technology (AT) to teach students with special educational needs in a study conducted in one of the schools by the Department of Special Education in one of the Tanzanian University. The survey revealed a significant problem of lack of knowledge and skills in using ICT, with more than 93% of participants saying they are not prepared or completely unprepared to provide IT services for students with disabilities in their special schools.

Despite policy development and financial investment in ICT in education, studies on teacher competencies in Kenyan primary schools demonstrate that technology integration in Kenyan classrooms remains low (Piper et al., 2015). Similarly, Langat (2015) found that most of the teachers in the study on barriers hindering the implementation of ICT in primary schools in Kenya lacked computer literacy skills. Teachers blamed the

government for the lack of effective planning to offer them in-service training on the use of technology in teaching and learning, despite being aware of the importance of technology in education. Murithi and Yoo (2021) discovered that after learning from their tutors, student-teachers were able to try using technology in the classroom to teach Kiswahili. Both studies suggest that after attending training sessions, teachers were willing to use technology in their classrooms.

Ashiono (2018) conducted a study on teachers' ICT competencies, access to ICTs, and usage of ICTs in classroom instructions. According to the findings, most teachers only had basic computer literacy skills, which they mostly obtained by personal effort. Most teachers lacked the necessary knowledge and skills to properly integrate ICT into their teaching and learning.

3. Research and Methodology

In this study, both quantitative and qualitative data were collected from 99 teachers from 41 public primary special schools using a semi-structured questionnaire tool. The questionnaire was semi-structured because it had a mix of both open-ended and closed-ended questions. To supplement quantitative data, interview guides and observation guides were used to collect qualitative data. As such, Mixed Methods Research (MMR) was used to synthesize both the datasets and continuous triangulation was applied to produce the final research report. MMR comprised the use of Statistical methods in form of descriptive analysis including frequencies and cross-tabulations. On the other hand, thematic analysis was conducted using the six-phase model proposed by Braun and Clarke (2006) this includes; (1) Familiarizing with your data, (2) Generating initial codes (3) Searching for themes, (4) Reviewing themes, (5) Defining and naming themes, and (6) Producing the report. Triangulation of quantitative and qualitative evidence was done on a continuous basis and a final research report was produced.

4. Results and Discussions

These results are based on an analysis of evidence gathered from 99 teachers out of whom 72.7 % were female while 27.3 % were male, 90% were aged between 40 and 59 years, 70% had 8 years or more of experience, 75.8% had at least a first degree in education and all teachers were specialized in at least one area of disability such as visual impairments, hearing impairments, autism, cerebral palsy among others. Data were also gathered from 41 headteachers out of whom 68.3% were female while 31.7 were male, 95.5% were aged between 40 and 59 years, 27% had leadership experience of more than 5 years and 59% of headteachers had at least a first degree as their highest academic qualification.

In examining teacher's ICT competency, a set of characteristics were examined including teacher's prior computer training and level thereof and self-reported competency in using different software and hardware components such as MS Office

products, printers, and basic installation among others. Table 1 presents the summary frequency distribution of teachers with or without prior training in computers.

Table 1: Attendance of Computer Training

Response	Frequency	Percent (%)
Yes	84	84.8
No	15	15.2
Total	99	100.0

The results presented in Table 1 show that at least 84.8% of teachers had attended some prior computer training. This result suggests that a vast majority of teachers had training in computer-related despite this impressive indicator of high teacher competency in ICT, available evidence from government reports such as Connecting Africa (2021) report indicated that only 60% of Kenyans aged between 14 and 64 have access to a laptop or desktop computer. It is worth noting that within this cohort, there are many students (at the University) and other professionals who are not necessarily teachers. This implies that the proportion of teachers who have access to laptops and/or desktop computers is far much less than the reported 60% in Connecting Africa (2021) report. Further still, the report indicated that only about 40% of the population have access to an internet connection, which has the potential to negatively impact individual competencies due to limitations in self-teaching and capacity building. This may as well negatively affect the quality of teaching and learning due to limited access to online resources.

The second aspect considered in assessing teachers' ICT competency was the level at which their prior computer training happened. This aspect was considered based on the understanding that prior computer training may not provide sufficient insights into one's competency. Table 2 presents a summary of the frequencies and proportions of 84.8% of teachers who reported to have had prior computer training.

Table 2: Level of Computer Training

Level	Frequency	Percent (%)
Certificate in computer	41	48.8
Computer packages certificate	24	28.6
DLP training	15	17.5
Part of degree programme	2	2.40
Other (self-taught, one-week training)	2	2.40
Total	84	100.0

The results presented in Table 2 suggest that at least 3 in 4 teachers (or 77.4%) reported having a certificate in computers. This conclusion is arrived at by combining the 48.8% who reported having a certificate in computer and 28.6% who had a computer package certificate. Among the most common computer certifications in Kenya include International Computer Driving License (ICDL) program and Computer packages short courses offered by mainly private enterprises (Street Colleges). A few public Institutions that offered computer proficiency courses include Kenya Institute of Special Education

(KISE) under the Innovate Project which halted in 2017. Even then, the majority of recruits in the innovative project were youth from high school. It is therefore unlikely that teachers have had a considerable admission into computer proficiency courses. Regarding ICDL, it is also unlikely that many teachers would consider enrolling in this program for two main reasons. First, the programmes take more than six months which is a long time considering the school calendar in Kenya. Secondly, the IDCL certification may be considered too expensive compared to an ordinary certificate in Kenya. For these reasons, it is also unlikely that that teacher had any formal certification in computer proficiency.

Results presented in Table 2 indicate that only 17.5% of teachers in public primary special schools have built their ICT competency skills courtesy of the DLP programme. This result may be believable to a great extent when this is examined in the context of the DLP report on teacher training. According to the DLP (2019), 75,000 teachers in public primary schools have been trained in readiness for the project implementation which accounts for 25% of target teachers at the primary school level. Given this result and assuming that Nairobi country is a representative of Kenya, we can deduce that the training of teachers in a public primary special school is 28.4% less than the national average of 25%. Clearly, we would expect a lot more discrepancy in public primary special schools that are in the rural areas since schools in Nairobi are generally privileged by the mere fact that they exist within the country's capital.

Further, the results also indicate that 2.4% of teachers built their ICT competencies by taking ICT-related units/courses/subjects as part of their pre-service training programmes while 2.4% reported having self-taught themselves. Inclusion of ICT-related subjects as part of pre-service teacher training programmes by universities and/or colleges is a concept introduced by individual institutions organs such as the university academic council or senate. In this regard, the extent to which these courses contribute to one's competency may vary depending on the individual universities. Additionally, the rigour with which these ICT subjects are taught varies with the individual institutions. The Teachers Service Commission (TSC) does not have ICT proficiency standards for new or practicing teachers.

The final aspect used in this study to measure teachers' ICT competency was self-reported proficiency in using various ICT tools, techniques, hardware, and software. To achieve this, 15 statements derived from the Digital Competence Framework for Educators (DigCompEdu) were presented to the teachers on a 5-point Scale such that 1= Strongly Disagree (SD); 2= Disagree (D); 3= Undecided (UD); 4= Agree (A); and 5= Strongly Agree (SA). The scores were then summed up row-wise and summary Statistics computed (Mean, Standard Deviation, and Rank) as presented in Table 3.

Table 3 shows that teachers who participated in this study rated themselves highly competent in using computers for communication purposes such as email (M=4.26, SD=0.91). These findings resonate with the current trends where it is almost impossible to find any practicing professionals such as teachers who do not have an email address. As such, it is expected that most teachers use emails for communication purposes. This

was followed by teachers who agreed that they know how to use a computer (M=4.15, SD=0.83). In terms of the basic computer packages, most teachers are most familiar with word processing program (M=4.09, SD=0.92) compared to presentation programmes, spreadsheet programs, and dataset programs. This may be so due to the frequency of program usability within a classroom setting and the complexity of the task each program is meant for. The use of the world wide web to access different types of information was also rated very high (M=4.07, SD=1.04).

Table 3: Descriptive Statistics on Self-Reported ICT Competency

Statement	Mean	Std. Dev	Rank	Degree of agreement
I can use the internet for communication (e.g., email).	4.26	0.91	1	Very high
I know how to use computer	4.15	0.83	2	Very high
I can operate a word processing program (e.g., Word)	4.09	0.92	3	Very high
I can use the world wide web to access different types of information	4.07	1.04	4	Very high
I can use a printer	3.93	1.18	5	High
I can use computers for grade keeping	3.74	1.06	6	High
I can use the computer in all my work	3.73	1.13	7	High
I have been trained on how to teach using a computer	3.72	1.33	8	High
I can operate a presentation program (e.g., PowerPoint)	3.68	1.24	9	High
I can create and organize computer files and folder	3.65	1.30	10	High
I can operate a spreadsheet program (e.g., Excel)	3.35	1.12	11	High
I can operate a database program (e.g., Access)	2.94	1.24	12	Medium
I can solve simple problems in operating computers operate a graphics programme (e.g., Photoshop)	2.93	1.34	13	Medium
I can install new software on the computer	2.90	1.29	14	Medium
I can select and evaluate software	2.58	1.33	15	Medium
Overall	3.58	1.15		Medium

Other computer skills in which teachers reported to have high competency levels include using a printer (M=3.93, SD=1.18), using computers for grade keeping (M=3.74, SD=1.06), using the computer in all their work (M=3.73, SD=1.13), teaching using a computer (M=3.72, SD=1.33), operating a presentation program (e.g., PowerPoint) (M=3.68, SD=1.24), creating and organizing computer files and folder (M=3.65, SD=1.30) and operating a spreadsheet program (e.g., Excel) (M=3.35, SD=1.12). A similar study was conducted in Indonesia (Son, Robb & Charismiadji, 2011) to evaluate teachers' computing skills based on three aspects: computer literacy, internet literacy, and typing skill. According to the study, 54.2% and 1.4% of teachers rated their own computer literacy as good and excellent respectively, 51.4% and 1.4% of teachers rated their internet literacy as good and excellent respectively while 51.4% and 2.8% of teachers rated their typing skills as good and excellent respectively. Even though Son et al.'s study was conducted almost a decade ago, the trend of self-reported teacher competency remains the same, that teachers tend to rate themselves as highly competent. A study conducted by Ngatia (2015) investigated teachers' preparedness for the use of ICTs in teaching and learning in regular public secondary schools in Nyeri County. The study findings revealed that

teachers were not adequately trained in the use of ICTs thus lowering the self-confidence of the teachers in the use of technologies in teaching and learning.

Further, the results indicate that most teachers are not confident in performing tasks that require Access (M=2.94, SD=1.24), Photoshop (M=2.93, SD=1.34), and Installation of the new software (M=2.90, SD=1.29) and the selection and evaluation of new software (M=2.58, SD=1.33). These results suggest that teacher competency may be limited to the basic usability of word processing programs and thus teachers may have trouble integrating digital skills in learning and teaching. For instance, the inability to use PowerPoint shows that most teachers may not be able to prepare presentation slides which are critical in learning and teaching. Inability to use excel and access programs show that teachers may experience difficulties in developing databases for monitoring learners' progress. In Zimbabwe, a similar study (Bukaliya & Mubika, 2011) was conducted to assess teacher competency in ICT and its implication for secondary school education in the country. The study revealed that in terms of applicability of the packages, teachers' weak knowledge levels show that their competence in ICTs for classroom use still lags. Clearly, the trend of teacher knowledge in packages remains the same most teachers are limited to the use of MS Word, leaving out other important and relevant skills of packages such as MS Access and Photoshop.

Basic software knowledge such as installation, selection and evaluation are important in integrating ICT in the learning and teaching process and this helped the teacher to have more control over the performance of the computer or any other gadget they are using. Thus, when a significant number of teachers are unable to demonstrate basic knowledge of software, then it is difficult to confidently claim that teachers are competent to implement the DLP program or any other ICT in the learning and teaching process. However, the issue of teachers' failure to demonstrate basic knowledge is not surprising.

5. Conclusions

It can be concluded that DLP has played a critical role in advancing teachers' ICT competency in Kenya. However, the focus on public primary special schools' labs by at least 28% compared to the national average of 25%. This may imply that teachers' ICT competency in public primary special schools is the weakest in Kenya's basic education. This study also concludes that whilst many teachers may report having competency in ICT skills, lack of access to digital devices and internet connectivity makes it difficult for such teachers not only to demonstrate their competency but also reflect the same in teaching and facilitating learning. This study also concludes that teachers' competency in assistive technology is lower compared to conventional ICT skills. This suggests that teachers in public primary special schools have limited relevant ICT skills to support teaching and learning for children with disabilities and special educational needs.

6. Recommendations

Based on the results and the conclusions drawn from the findings of this study in the context of existing knowledge and inclusive education policies, this study makes the following recommendations:

- 1) The study recommends that education stakeholders such as the Teachers Service Commission (TSC) and teacher training Institutions develop an ICT Teacher Proficiency Framework that can be used as a benchmark in teacher training, hiring, and appraisal.
- 2) The study recommends that education stakeholders in the country should consider the implementation of the UNESCO ICT Competency Framework for Teachers (ICT-CFT) to simultaneously influence ICT policy and practice in Kenya.
- 3) The study recommends that the government make a deliberate effort to build teacher capacity in assistive technology to enable teachers to teach children with disabilities and special educational needs.
- 4) The study recommends that the Ministry of ICT, innovations, and youth affairs should be involved in technical working committees when designing ICT proficiency courses by universities and other teacher training institutions. This will help to equip the teachers in ICT knowledge acquisition, deepening, and creation.
- 5) This study recommends that future research on teachers' ICT competency focus exclusively on assistive devices and technology with the aim of assessing the extent to which children with disabilities and special educational needs can benefit from technology

Conflict of Interest Statement

The authors declare no conflicts of interest.

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