



Teacher Perceptions and ICT Policy Implementation in Physics Instruction: The Case of Public Secondary Schools in Matayos Sub County, Kenya

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Abstract: Information and Communication Technology has become an integral component of education systems. The Kenyan government introduced the ICT Policy of 2021. This policy outlines integration of ICT into instructional practices across all schools. Despite various efforts to incorporate ICT in education, performance in Physics continues to decline during. In Matayos Sub-County, there is limited documentation on how teacher perceptions have influenced Physics instruction in public schools. The study assessed Physics teachers' perceptions of the ICT policy. It adopted a descriptive research design, gathering data from 71 educators comprising 23 principals selected purposively and 48 Physics teachers selected by simple random selection. The theoretical framework guiding this research was the Diffusion of Innovations Theory. Expert input was used to validate the research instruments, while reliability was tested using Cronbach's alpha coefficient. Data was analyzed using descriptive statistics. Notably, 100% of respondents believed that training on basic ICT tools was a waste of time. Additionally, 96% felt that training on basic ICT tools was irrelevant to their specialty. Majority recognized the importance of learning to use the internet for their work, with 68% agreeing and 32% strongly agreeing. 86% of the respondents agreed that they needed further training to use ICT, 76% of respondents were satisfied with their traditional way of instruction while 56% of the respondents did not intend to adopt ICT for instruction; 86% loathed ICT use. The findings present the need to improve the provision of ICT resources in schools and to invest in teacher training and attitude change.

Keywords: ICT Policy Implementation, Physics Instruction, Teacher perceptions/attitudes, Matayos Sub County

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1. Introduction

The implementation of Information and Communication Technology (ICT) policies in education has fast morphed into a global priority as nations seek to improve teaching effectiveness and prop learners for the digital age. In Physics education, ICT tools such as simulations, virtual laboratories, artificial intelligence (AI), multimedia platforms, and interactive applications are quickly recognized for enhancing conceptual understanding and learner engagement. A wide body of recent literature

indicates that successful ICT policy implementation hinges on teachers' perceptions, attitudes, and readiness to integrate technology into classroom instruction. Teachers who see ICT as important and pedagogically convenient are more likely to adopt innovative teaching strategies in Physics lessons (Abel et al., 2022).

Cutting edge literature further shows that despite increased governmental investment in digital learning policies, many schools continue to face challenges related to infrastructure, inadequate professional development, limited internet connectivity, and

insufficient institutional support. These bottlenecks negatively influence teachers' attitudes toward ICT implementation, particularly in science subjects that demand practical demonstrations and experimentation (Ntorukiri et al., 2022). In sub-Saharan Africa, teachers of Physics often express positive attitudes toward ICT integration but exude difficulties in translating policy expectations into actual classroom practice because of limited technological resources and limited training, (Murithi and Yoo, 2021).

Emerging research in Physics education has also drifted towards advanced digital innovations such as simulations and generative artificial intelligence (GenAI). Contemporary studies reveal that Physics instructors fast recognize the importance of simulation technologies and AI-driven tools in supplementing inquiry-based learning and visualization of abstract concepts. However, teachers' implementation decisions are vastly influenced by school leadership, policy support, institutional culture, and technological competence (Badmus et al., 2026). Similarly, research in Physics instruction such as generative AI shows that instructors' acceptance of digital innovations depends on perceived usefulness, ease of use, and confidence in technology adoption (Wattanawasiwich et al., 2025).

In the year 2021 the Ministry of Education enacted the policy on information and communication technology. The 2021 ICT Policy provides a framework of leveraging the digital divide, implementing ICT in education, and provides a tool for curriculum delivery and education management. The Policy posits that, in the National Education Sector Strategic Plan (NESSP), 2018-2022, institutions would use ICT as a pedagogical tool to enhance education. The Policy is split into seven chapters, namely: background and situation analysis, legal contexts and objectives, policy provision, which includes equity and access, amongst others, resource mobilization and partnerships (Kiarie and Jones, 2024). While the policy gets implemented there is need to appraise it to ascertain its effectiveness in STEM instruction. In a nutshell, examining teachers' perceptions toward ICT policy implementation in Physics instruction is critical for deciphering the factors that exacerbate or impinge effective technology integration in contemporary science classrooms the case of ICT policy, 2021.

2. Literature Review

2.1 Teacher Perceptions towards ICT policy implementation in Physics Instruction: A literature Review

Investigating teachers' attitudes/ perceptions towards the use of ICT in physics instruction is crucial (Awour and Okono, 2022). Classroom teachers are the key

implementers of the ICT policy; integrating ICT in their teaching and learning as well as facilitating learners to embrace ICT outside the classroom (Mukhula, 2021). According to Davis et al, (1989) the actual use of ICT hinges upon perceived usefulness, perceived use and behavioral intention to use. The implication is that teacher attitudes, whether positive or negative, alongside their competencies in ICT, are likely to affect overall ICT policy implementation. Teacher competency involves a teacher understanding ng the type of pedagogy to bring into a learning environment. The competence helps the teacher to associate technology with the content and utilize it to real life situations in turn facilitating a better understanding of the content. A broad body of knowledge has proven that the attitudes of teachers towards integration of ICT into pedagogy is highly correlated with their competencies. Most research studies report that positive teacher perceptions and effective ICT use is due to the teacher's knowledge levels and beliefs of knowledge (Hennessy et al., 2022). According to UNESCO ICT Competency Standards for Teachers, (2008) there are four key competencies that are key success of ICT integration in teaching, they include; pedagogy, collaboration and networking, social issues and technical issues (UNESCO, 2008). Some studies such as Salem & Mohammadzadeh, (2018) postulate that presence of ICT infrastructure is not significant unless the teacher has the required perception and competency on how to properly integrate ICT in teaching and learning. Further, Salem & Mohammadzadeh, (2018) opine that when teaching staff have no technical skills, they become anxious on encountering a technical problem. It is worth noting that before an institution can successfully integrate ICT in teaching, it needs to ensure that the teaching staff acquire appropriate ICT and pedagogical skills to inform strong positive perceptions (Rabah, 2015). Such skills enable the teachers to have the self-drive and enthusiasm to integrate ICT in teaching and learning.

Various studies have examined teachers' attitudes in integration of ICT. Jimoyiannis & Komis, (2006) reported that attitude toward computers and ICT is a multi-faced variable. Many instruments exist to measure attitudes toward computers in education. The key variables measured include anxiety; fear or cautiousness of using computers and ICT tools; Self-efficacy and confidence in the ability to use ICT; Liking to use computers and new ICT tools; Beliefs and perceptions about the value and usefulness of using ICT in education. Some studies have investigated students' and teachers' attitudes toward computers and their correlates to various variables such as age, gender. Research has revealed gender differences in teachers' beliefs and engagement with ICT (Jimoyiannis & Komis, 2006).

Afzal et al. (2015) examined secondary school teachers' perceptions and needs regarding e-learning for physics instruction in Pakistan. Their study aimed to deepen understanding of teachers' behavioural intentions toward ICT use in physics teaching. The findings identified key

factors such as pedagogical aspects, performance expectancy, facilitation conditions, behavioural intentions, social influence, and training needs as essential prerequisites for the effective integration of ICT in physics education. Building on this, the current study will also explore teachers' views on the implementation process, their level of involvement, and the support they receive.

Teacher competencies are vital determinants of teacher perceptions in successful ICT integration in schools. Murithi and Yoo (2021) emphasize that policies should prioritize staff development and support by strengthening ICT competencies through both pre-service teacher preparation and continuous professional development. Moreover, studies highlight the importance of STEM teachers graduating with strong ICT competencies. Mudaly and Chirikure (2023) argue that factors such as industry demands, the increasing importance of digital literacy and ICT skills in careers, and the broader influence of neoliberal agendas contribute to the growing need to produce STEM graduates equipped with both ICT and STEM expertise as well as positive perceptions.

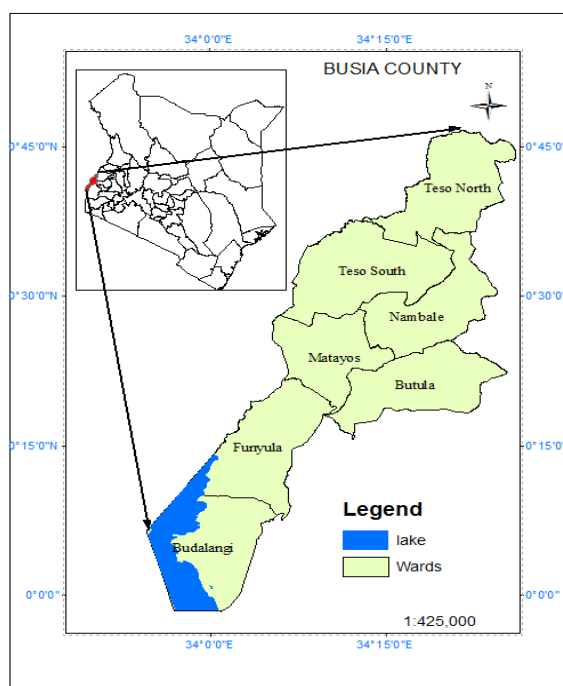
Most available literature review has examined the attitudes and perceptions of teachers towards ICT usage for general instruction in Kenyan schools (Esokomi,2019; Kisirkoi,2015; Wabuye,2003). Few studies have explored how Kenyan teachers' perceptions towards ICT policy affect physics instruction. A study by Kibos, (2011) conducted research on teacher/pupil perspectives on computer-augmented physics lessons on measurement in Kenyan secondary schools. The findings revealed that ICT has the potential to enhance their learning of measurement concepts and methods.

Furthermore, it was revealed that the ICT experience influenced the teacher's belief about teaching with ICT to augment physics instruction (Kibos, 2011).

3. Methodology

The study adopted descriptive research design. This design is suitable because it allows the study to capture the current status of ICT policy implementation in physics instruction while also examining the relationships between key factors such as resource availability, teacher perceptions, student engagement, overall student academic performance, and classroom use. Since these variables cannot be manipulated, the design provides a practical way to generate meaningful insights into how ICT policies influence teaching outcomes in real school settings (Ellis and Hart, 2023). Matayos Sub-County was selected for this study due to its suitability in examining teacher perceptions in ICT policy implementation in Physics instruction in public secondary schools. As part of the national framework developed by the Ministry of Education Kenya, ICT integration in education is expected to be uniformly implemented across the country; however, variations exist at the local level. Matayos Sub-County presents a representative setting with a mix of rural and peri-urban schools that face common challenges such as limited ICT infrastructure, inadequate teacher training, and low integration of technology in science subjects like physics. Additionally, despite initiatives such as the Digital Literacy Programme Kenya, the extent to which ICT has been effectively incorporated into physics instruction remains unclear. Therefore, the sub-county provides a relevant and feasible context for evaluating the gap between policy and practice.

Figure 1: Map of Busia County



The study targeted all the 23 public secondary schools consequently 23 principals were selected purposively while 48 teachers of physics were selected by simple random selection. The study used three instruments to collect data: questionnaire; in depth interview, and observation checklist. Research instruments were pilot tested before the actual collection of data from the field. The researcher administered the questionnaires to participants. This was followed by a debriefing session with them to give their assessment of the instruments for clarity, appropriateness, relevance, comments, suggestions and corrections which were incorporated into the research instruments before undertaking the actual study.

Validity was confirmed by presenting to faculty research staff. The study utilized Cronbach Alpha coefficient to determine the reliability. The method required only a single test to determine internal consistency of instruments. The Cronbach's alpha was 0.8316, which is within the acceptable range according to Hair et al., (2011). To ensure additional reliability of the study, the researcher endeavoured to check the instruments to ensure that they do not contain mistakes or ambiguities. To ensure the trustworthiness of the qualitative data collected, triangulation and member check approaches were used. Data methods as well as data source triangulation, were done. The researcher compared data gathered using various methods as well as relied on the significance of the variety in persons conducting the interviews and observation. This was crucial in determining the respondent's credibility and dependability. In terms of credibility, after the interview, the researcher conducted a member check to confirm whether their views were accurately captured. The researcher conducted consistent testing of conclusions, interpretations and research data with the informants. Additionally, there was a terminal member check with principal informants to allow for testing of the general interpretation and to ensure that the data's final presentation is an accurate reflection of the experience

The researcher considered several ethical considerations: The researcher obtained necessary approval permits from the Ethical Review Committee of Masinde Muliro University of Science and Technology and adhered strictly to ethical principles to protect respondents' dignity and emotional well-being. Participants were assured of confidentiality, anonymity, non-traceability, non-maleficence, beneficence, informed consent, and the right to withdraw or skip questions at any time. To maintain privacy, respondents were instructed not to write their names on questionnaires. Participation was voluntary, with respondents free to choose whether to partake in the study. Written authorization was also secured from relevant organizations connected to the study. All collected data were treated with the utmost

confidentiality and used solely for academic purposes. Furthermore, the researcher employed plagiarism detection tools to ensure the integrity and originality of the work. Upon meeting the requirements for the research proposal at the faculty, a letter from the university was obtained for the purpose of data collection. The researcher proceeded to seek research authorization from the County Director of Education in Busia County. Thereafter a visit was made to the Matayos Sub-County Education office for introduction, creating rapport and getting permission to conduct research. Visits were made to schools to drop questionnaires for students and teachers which were collected after two days. Arrangements were made with the principals and the sub county director of education on possible timing of the in-depth interviews.

In determining the perceptions of teachers of Physics towards ICT policy implementation in physics instruction following the policy implementation, the quantitative data collected was coded, cleaned and relevant diagnostic analysis conducted. The quantitative data was descriptively analyzed and presented in tabular form.

4. Results and Discussion

4.1 The Perceptions of Physics Teachers Towards ICT Policy Implementation in Physics Instruction

To assess teachers' perceptions of ICT policy implementation, physics teachers were asked to respond to statements regarding their attitudes, perceived barriers, and the support systems related to ICT policy in their schools. A summary of their responses is presented in Table 1. Notably, 100% of respondents (86% strongly agreed and 14% agreed) believed that training on basic ICT tools was a waste of time. Additionally, 96% (51% strongly agreed and 44% agreed) felt that training on basic ICT tools was irrelevant to their specialty, while only 6% disagreed. Conversely, a majority recognized the importance of learning to use the internet for their work, with 68% agreeing and 32% strongly agreeing.

However, the results also indicated that most respondents disagreed with the statements that learning to use ICT was important for their job (93% disagreed) and that ICT has the potential to improve physics performance (100% disagreed). These negative attitudes towards ICT among teachers could significantly hinder the adoption and integration of technology in teaching. Even with excellent ICT facilities, negative teacher perceptions may prevent effective use in instruction. Therefore, targeted interventions aimed at transforming teachers' perceptions and empowering them to lead ICT policy implementation are crucial. Table 1 below also

summarizes some positive, negative and neutral attitudes from the responses of teachers.

Table 1: A Summary of Teachers Perception, Attitudes, Barriers and Support for ICT Policy Implementation in Instruction of Physics

Statement	Strongly Disagree n (%)	Disagree n (%)	Agree n (%)	Strongly Agree n (%)
Perception				
Training on ICT basic tools is a waste of time	0 (0)	0 (0)	10 (14.1)	61 (85.9)
Training on ICT basic tools does not concern my specialty	0 (0)	4 (5.6)	31 (43.7)	36 (50.7)
My job requires me to learn how to use ICT	36 (50.7)	30 (42.3)	2 (2.8)	3 (4.2)
My job needs to learn how to use the Internet	0 (0)	0 (0)	48 (67.6)	23 (32.4)
ICT has the potential to improve performance in physics	23 (32.4)	48 (67.6)	0 (0)	0 (0)
Attitude				
I am satisfied with my teaching approach	3 (4.4)	20 (29.4)	31 (45.6)	14 (20.6)
Using new ICT tools in teaching is very interesting to me	20 (28.2)	20 (28.2)	0 (0)	0 (0)
I do not want ever to use ICT in my education career	0 (0)	0 (0)	28 (39.4)	43 (60.6)
I am cautious about using ICT in my career	4 (5.6)	13 (18.3)	16 (22.5)	38 (53.5)
I find it difficult using ICT for instruction	0 (0)	6 (8.5)	47 (66.2)	18 (25.3)
I want to be trained on ICT but I am afraid that I will not succeed	0 (0)	10 (14.1)	28 (39.4)	33 (46.5)
I believe that I will not be able to use ICT in my instructional practice because I feel insecure about its application	0 (0)	0 (0)	38 (53.5)	33 (46.5)
If I had a computer in my class, I could use it in instruction	13 (20.3)	46 (71.9)	5 (7.8)	0 (0)
I am scared some students are more skilled than me in ICT use	2 (3.1)	23 (35.9)	16 (25)	23 (35.9)
I need more training on ICT use before applying it in instruction	0 (0)	9 (14.1)	44 (68.7)	11 (17.2)
Barriers to ICT Policy Implementation				
Allocation of physics periods is not adequate for using ICT	6 (8.5)	25 (35.2)	27 (38.0)	13 (18.3)
There aren't enough technicians for computer lab	21 (29.6)	16 (22.5)	26 (36.6)	8 (11.3)
There aren't internet services in classrooms	9 (12.7)	16 (22.5)	25 (35.2)	21 (29.6)
Computers aren't sufficient for students	8 (11.3)	21 (29.6)	12 (16.9)	30 (42.3)
Computer labs are available for physics	15 (21.1)	19 (26.8)	19 (26.8)	18 (25.4)
Classes are too crowded for ICT use	2 (2.8)	13 (18.3)	36 (50.7)	20 (28.2)
Physics curriculum is not appropriate for ICT	2 (2.8)	3 (4.2)	21 (29.6)	45 (63.4)
Downloading and using computer physics programs is difficult	5 (7.0)	6 (8.5)	25 (35.2)	35 (49.3)
ICT vision is integrated into the whole school plan	0 (0)	45 (67.2)	22 (32.8)	0 (0)
Supportive System				
Training on ICT pedagogy development issues is necessary	7 (9.8)	0 (0)	22 (31)	42 (59.2)
A well-organized supportive and collaborative process should be established	0 (0)	8 (11.3)	26 (36.6)	37 (52.1)
I need more effective educational software that covers my area	0 (0)	4 (5.6)	42 (59.2)	25 (35.2)
ICT infrastructure development is crucial for schools	0 (0)	4 (5.6)	22 (31)	45 (63.4)
I am satisfied with the process of ICT integration in schools	15 (21.1)	31 (43.7)	9 (12.7)	16 (22.5)

On the one hand, some positive attitude towards ICT Policy implementation were derived from responses to statements such as: they need more training on ICT use before their application in the instructional process represented by 86% of the respondents who agreed. This implies that policy should consider further training needs of teachers for ICT preparedness. Teacher education trainers need to augment their training methodologies to focus more on ICT use.

On the other hand, some of the negative attitudes towards ICT Policy implementation were derived from responses to statements, such as: teachers were satisfied with their teaching approach, represented by 76% of respondents who agreed; using new ICT tools in teaching was not interesting to them, represented by 56% of the respondents who disagreed; they do not want ever to use ICT in their education career represented by 100% who agreed; have difficulties in using ICT for instruction (91.5% agreed); they want to be trained on ICT but are afraid they will not succeed represented by 86% who agreed; they believe that they will not be able to use ICT in their instructional practice because they feel insecure about its application in education represented by 100% of those who agreed; If they had computer in my class, they could use it in instruction of subject matter represented by 92.2% who disagreed and that teachers are scared some students are more skilled than them in ICT use represented by 61% of those who agreed. Some of the neutral attitudes from the responses include: teachers are cautious about using ICT in my career represented by 76% of respondents who agreed. These findings present a myriad of beliefs and positive and negative concerning utilization of ICT for Physics teaching and learning and by extension depict the gaps that need to be bridged both for teacher educators and school administrators for effective ICT policy implementation. These findings relate to a study by Siorenta & Jimoyiannis, (2008) on ICT use for Physics instruction. The study presents a set of three teachers based on their beliefs albeit perceptions: A group of traditional teachers, whose beliefs are dominated by rigorous presentation of the physics content while they are unwilling to incorporate laboratory and ICT-based activities in their classroom practice; a second one consisted of non-traditional teachers, who are positive about the adoption of laboratory and ICT-based subject instruction; a third group of undecided teachers who combine elements of both belief structures and vacillate between traditional and non-traditional approaches. Further, the researchers established that personal factors such as teaching experience, age, teacher training and ICT competence are strongly associated with teachers' beliefs and perceptions. The findings concur with those by researchers: (Afzal et al, 2015, Rabah, 2015, Salem & Mohammadzadeh, 2018)

On the other hand, some negative attitudes towards ICT policy implementation were evident from teacher responses to various statements. For instance, 76% of

respondents agreed that they were satisfied with their current teaching approaches. Meanwhile, 56% disagreed with the idea that using new ICT tools in teaching was interesting to them. Notably, 100% agreed that they did not want to ever use ICT in their educational careers, and 91.5% acknowledged having difficulties using ICT for instruction. Furthermore, 86% expressed a desire for ICT training but feared they would not succeed, while 100% felt insecure about applying ICT in their instructional practice. When asked if having a computer in the classroom would enable them to use it for teaching, 92.2% disagreed. Additionally, 61% agreed that they were intimidated by students who are more skilled than them in ICT use. Neutral attitudes were also observed, with 76% agreeing that they were cautious about using ICT in their careers.

These findings reveal a complex mix of positive and negative beliefs about the use of ICT in physics teaching and highlight significant gaps that must be addressed by teacher educators and school administrators to ensure effective ICT policy implementation. These results resonate with the study by Siorenta and Jimoyiannis (2008), which identified three categories of teachers based on their beliefs and perceptions: (1) traditional teachers, who prioritize rigorous physics content presentation and resist incorporating laboratory and ICT-based activities; (2) non-traditional teachers, who positively embrace laboratory and ICT-enhanced instruction; and (3) undecided teachers, who fluctuate between traditional and non-traditional approaches. Furthermore, the study found that personal factors such as teaching experience, age, teacher training, and ICT competence strongly influence teachers' beliefs and perceptions. These findings align with those of Afzal et al. (2015), Rabah (2015), and Salem and Mohammadzadeh (2018), who similarly emphasized the role of personal and contextual factors in shaping teachers' attitudes toward ICT integration.

Based on the findings here it's worth noting that teachers' attitudes/ perceptions towards the use of ICT in physics instruction is crucial in policy implementation since subject teachers are the primary implementers of the ICT policy (Awour and Okono, 2021; Mukhula, 2021). According to Davis et al, (1989) the actual use of ICT hinges upon teachers perceived usefulness, perceived use and behavioral intention to use. The implication is that teacher's attitudes whether positive or negative alongside their competencies in ICT are likely to affect overall ICT policy implementation. Teacher competency involves a teacher understanding the type of pedagogy to bring into a learning environment. Competence helps the teacher to associate technology with the content and utilize it to real life situations in turn facilitating a better understanding of the content. A broad body of knowledge has proven that the attitudes of teachers towards integration of ICT into pedagogy is highly correlated with their competencies. From the findings policy implementation has suffered

setbacks since majority believe that utilizing ICT tools and capacity building for its utilization does not concern their specialization.

The research findings do not support the findings by several researchers (Almerich et al,2016; Dzikite et al;2017; Gropen et al,2017;) who assert that for successful rollout of ICT integration into teaching and learning, there should be adequate personnel that have the necessary attitudes, perceptions and competences. The findings here are typically contrary and as such it becomes very difficult to deploy ICT in teaching and learning (Hennessy et al., 2022). Some studies such as Salem & Mohammadzadeh (2018) postulate that presence of ICT infrastructure is not significant unless the teacher has competency on how to properly integrate ICT in teaching and learning. Further, Salem & Mohammadzadeh, (2018) opine that when teaching staff have no technical skills, they become anxious about encountering a technical problem. It is worth noting that before an institution can successfully integrate ICT in teaching, it needs to ensure that the teaching staff acquire appropriate ICT attitudes and pedagogical skills (Rabah, 2015). Such skills enable the teachers to have self-drive and enthusiasm to integrate ICT in teaching and learning.

Some researchers have sought to explain teachers' perceptions and attitudes toward ICT policy implementation. Jimoyiannis and Komis (2006) described attitude toward computers and ICT as a multifaceted variable encompassing anxiety or fear, cautiousness in using ICT tools, self-efficacy and confidence in ICT skills, enjoyment of using technology, and beliefs about the educational value of ICT. This framework aligns with other studies exploring the attitudes of both students and teachers toward computers, considering factors such as age and gender (Afzal et al., 2015; Jimoyiannis & Komis, 2006).

5. Conclusion and Recommendation

5.1 Conclusion

The purpose of this study was to assess the perceptions of physics teachers towards ICT policy implementation in physics instruction. The study established that majority of teachers and principals had a strong inclination for traditional teaching approaches. They harbored negative perceptions and attitudes towards ICT policy implementation in Physics instruction owing to inadequate technical capacity, a non-enabling environment and time constraints. This was not supportive to effective ICT policy implementation.

5.2 Recommendations

The findings from this study highlight the critical need for education policy to prioritize staff development and ongoing support, ensuring that ICT forms an integral part of both pre-service teacher training and continuous professional development. Given the global emphasis on STEM education, which increasingly demands digital literacy and ICT competencies, there is a pressing need to produce more highly skilled professionals with positive attitudes and enabling perceptions toward ICT use in education. Strengthening teacher preparedness in ICT is essential to achieving this goal and advancing the broader educational agenda.

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