

Primary school teachers' knowledge and preparedness for the integration of artificial intelligence in Muheza District Council in Tanzania

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ABSTRACT

The use of Artificial Intelligence (AI) in education systems is becoming a reality, and teachers' conceptual awareness, pedagogical skills, Information and Communication Technology (ICT) skills, and enabling conditions are all important in achieving this use in a responsible manner. This is an exploratory study using a convergent mixed-methods research methodology that explored the self-reported familiarity, knowledge and preparedness of primary school teachers in Muheza District Council, Tanga Region, Tanzania with the use of artificial intelligence. The primary schools selected were ten primary schools (7 public and 3 private) and teachers were recruited by convenience sampling. In the quantitative strand, 91 questionnaires were returned, while in the qualitative strand, 20 semi-structured interviews were obtained. The data collected from the questionnaires were analyzed descriptively by calculating the frequencies and percentages. Interview results were analysed into themes and combined with the quantitative results by domain. Technological Pedagogical Content Knowledge (TPACK) and the Unified Theory of Acceptance and Use of Technology (UTAUT) were employed interpretively as lenses and not as a model. The percentages of agreement for the five self-reported familiarity and knowledge items ranged from 58.2% to 82.4%. Overall, 47.3% of teachers said that they use AI tools in their teaching, 53.8% said they had digital skills to use AI, and 40.7% said they had reliable Internet access. The interviews corroborated these findings, indicating a lack of uniformity in conceptual understanding, pedagogical value and training requirement, as well as a need for devices, connectivity, electricity, and institutional support. This study concludes that the level of readiness between and within domains, however, was not uniform, and the teachers were not clearly categorized as 'knowledgeable' or 'unprepared'. The findings are not generalizable to primary school teachers in Tanzania because the sample was non-probability, data were self-reported and the quantitative data were available only with aggregated outputs. The study provides context-specific evidence to support the application of Tanzania's 2026 national guidelines on digital education and AI in education, as well as education professional development for teachers in low-resource primary schools. This study recommends that the Ministry of Education, Science and Technology and its implementing agencies should ensure that the 2026 National Guidelines for Artificial Intelligence in Education and the National Digital Education Guidelines for Schools and Teacher Colleges are communicated, resourced, implemented, and monitored, with a focus on rural primary schools.

Keywords: AI Literacy; Artificial Intelligence; Mixed Methods; Primary Education; Teacher Preparedness; Tanzania

I. INTRODUCTION

Teachers are getting greater access to digital resources as a result of Artificial Intelligence (AI) tools, including generative AI systems, adaptive technologies and automated assessment systems. Meanwhile, schools and education systems are encouraged to make principled decisions on AI, rather than keeping up with technology trends. For instance, the U.S. Department of Education (2023) highlights the importance of human oversight, educational objectives and risk management. The AI Competency Framework for Teachers of the United Nations Educational, Scientific and Cultural Organization (UNESCO) presents five dimensions of competence of teachers in the field of AI: a human-centred mindset, the ethics of AI, AI foundations and applications, AI pedagogy, and AI for professional development (Miao & Cukurova, 2024). Digital Promise, similarly, defines AI literacy as the ability to understand, evaluate and use AI systems, and not just particular tools (Mills et al., 2024).

The expectations are significant in low-resource school systems as the excitement for new technology is sometimes coupled with restricted access to devices, connectivity, electricity, technical support, and professional development. It has been found that positive attitudes towards technology do not guarantee classroom use in the context of limited facilities and pedagogical skills in secondary classrooms in Tanzania (Kalinga & Ndibalema, 2023) and primary schools in Kenya (Murithi & Yoo, 2021). The ICT competence of Tanzanian teachers and tutors is also highlighted in the research that reveals a low level of ICT knowledge in relation to its pedagogy. The research also indicates that there is a gap between basic ICT knowledge and pedagogy use by teachers and tutors in Tanzania (Lubuva et al., 2022; Kalinga & Ndibalema, 2023). To integrate ICT into teacher's work, professional learning communities (PLCs) can be used to achieve this, but it needs to be supported by school and system level conditions (Ngao & Sang, 2024).

There is only beginning to be evidence for the use of AI in Tanzania. The teachers within the study were 120 secondary school teachers in Dar es Salaam and Dodoma who have experimented with generative AI tools were found to be beneficial for personalised learning, lesson planning and assessment, but they require more support in terms of training and infrastructure. The Tanzanian studies on AI and ICT located for this paper concentrate on secondary schools and teacher colleges. This means that there is a lack of representation from primary schools, particularly in rural areas.

The policy landscape is also rapidly evolving in Tanzania. The Ministry of Education, Science and Technology (MoEST) has developed the Education and Training Policy (2014) (2023 edition), which supports the digital transformation in education. MoEST has since published a set of guidelines for nationwide use in schools titled the National Digital Education Guidelines for Schools (MoEST, 2026a), and a set of guidelines for the use of AI in education titled the National Guidelines for Artificial Intelligence in Education (MoEST, 2026b). The question now is not if there is national guidance, but what is it? Whether teachers and schools have the knowledge, skills, infrastructure and institutional support to implement that guidance fairly. The background set in the above, the present exploratory study is based on a sample of primary school teachers of Muheza District Council. It does not consider preparedness a single validated scale. Rather, it examines individually the reported domains of familiarity with and knowledge about AI, use of AI in the classroom, self-perceived digital competences, perceived usefulness, infrastructure for enabling AI, and perceived institutional support needs. This method was required because there was no psychometrically valid composite measure available for the questionnaire to assess overall preparedness (see Section 2.1.3). Accordingly, the study aim to explore primary school teachers' preparedness to integrate AI into teaching by examining these interrelated dimensions.

1.1 Statement of the Problem

Tanzania is stepping towards formal directives on the integration of digital technology and Artificial Intelligence (AI) in learning. The challenge is to make sure that teachers understand what AI can do, can judge its outputs critically and can build it into their teaching in a pedagogically sound way, and that they have the infrastructure and professional support to do so. There is existing evidence in Tanzania showing that teachers' proficiency with ICTs and digital inequality are uneven (Lubuva et al., 2022; Kalinga & Ndibalema, 2023). Despite this, AI tools offer promising advantages for secondary school educators, which are hindered by a lack of teacher training and school support, as indicated by emerging AI research (Kamaghe, 2026). This evidence does not reveal the extent of preparedness of primary school teachers, especially in rural areas where conditions for connectivity, devices, and electricity and the availability of professional learning might vary greatly from those in more highly resourced areas.

There is a lack of evidence about how well primary school teachers are equipped to use AI, what they actually use AI for in their classrooms, their reported digital skills, and what makes them feel they are doing well or have barriers in using AI. This poses a real challenge to district and national planners. Investment in professional development and infrastructure may be poorly matched to need, if there is no baseline information on what teachers know, how they already use AI and what support they say they need. This is one of the areas addressed in the present study. It leverages questionnaire and interview data from Muheza District Council to characterize teachers' familiarity and knowledge, their reports of use and perceived usefulness of AI, and enabling conditions they report. It does not reflect demonstrated competence, or the causal impacts of AI on learning.

1.2 Research Objectives

- i. To establish the levels of self-reported AI familiarity and knowledge of participating primary school teachers.
- ii. To examine what participating teachers report about AI-related classroom use, digital skills, access to enabling infrastructure, and institutional support needs.

II. LITERATURE REVIEW

2.1 Theoretical Review

2.1.1 Technological Pedagogical Content Knowledge (TPACK)

Technological Pedagogical Content Knowledge (TPACK) theory emphasizes that it is technological, pedagogical and content knowledge (TCK) interactions that make it possible to integrate technology meaningfully into education (Mishra & Koehler, 2006). Both are helpful for AI in education. If teachers are aware of the existence of AI or can name some AI tools, this does not ensure that they know how to use it in an appropriate manner to teach a specific content to specific learners. With that distinction comes an interpretation of the difference between technological awareness (Objective 1) and pedagogical use (Objective 2) in this study, which is addressed by TPACK. The study was not designed to measure the TPACK domains, thus it is not a complete measure of TPACK.

2.1.2 Unified Theory of Acceptance and Use of Technology (UTAUT)

Venkatesh et al., (2003) have identified four factors in the Unified Theory of Acceptance and Use of Technology for technology acceptance and use: performance expectancy, effort expectancy, social influence, and facilitating conditions. UTAUT combines eight former models of technology acceptance, such as diffusion of innovations, which explains technology adoption based on the characteristics of the innovation, communication channels and time (Rogers, 2003). In this case, the perceived usefulness (corresponding to performance expectancy) and the enabling conditions of connectivity, electricity and devices (corresponding to facilitating conditions) are explained by UTAUT. The study is not a statistical test of the UTAUT constructs because not all of the UTAUT constructs were operationalized within this questionnaire.

2.1.3 The UNESCO AI Competency Framework and the Conceptualisation of Preparedness

Here the framework of the UNESCO AI Competency Framework for Teachers (Miao & Cukurova, 2024) is presented as a descriptive, but not causal framework. It has five dimensions which demonstrate that teacher preparedness in using AI is multi-dimensional. The framework is used to direct the discussion on the content of the current instrument and what of future readiness to measure in Tanzania.

For this study, therefore, 'preparedness' is not considered as one construct. It defines preparedness as a set of related but empirically distinct domains, which include: understanding of concepts and tools of AI; self-reported use in classroom; digital skills self-rating; perceived usefulness in teaching and learning; access to infrastructure to enable AI use (connectivity, devices and electricity); and perceived institutional support. The AI literacy groups offered by Digital Promise classify AI literacy into two components: understanding and evaluating AI systems (Mills et al., 2024), and using AI systems (Mills et al., 2024). The UNESCO framework categorizes AI literacy into four groups: awareness, ethics, pedagogy and professional development (Miao & Cukurova, 2024). Similarly, the five self-report items in this study (K1, K2, K3, K4 and K5; see Section 3.5) are conceptually separate. They should not be interpreted as an 'AI preparedness' score and they aren't. This is maintained in the findings and discussion.

Another factor to determine if teachers are prepared to use AI is AI literacy. It has been recently recognized as a multidimensional competence that encompasses knowledge of concepts of AI, use of AI applications, critical evaluation of AI outputs, awareness of ethical issues, and pedagogical decisions regarding the use of AI in learning (Miao & Cukurova, 2024; Mills et al., 2024). Research on teachers indicates that a higher level of knowledge about AI correlates with higher trust in AI, and that higher levels of knowledge of AI correlates with higher beliefs and attitudes which in turn correlates with higher integration of AI in class (Lucas et al., 2024; Kazmaci et al., 2025). AI literacy can thus be considered as a foundation of teachers' preparedness and the use of AI in the classroom.

2.2 Empirical Review

2.2.1 Teachers' AI Familiarity and Knowledge

Research indicates that teacher preparation levels correlate significantly with knowledge of AI, though the relationship is not always direct and is dependent on the level of preparation. Wang et al. (2023) surveyed 3,164 primary school teachers in China and defined AI readiness in terms of cognition, ability, vision and ethics. Cognition, ability and vision were positively linked to ethical considerations, all four positively related to AI-enhanced innovation and a cluster analysis revealed three distinct readiness groups of teachers. Kazmaci et al. (2025) conducted a survey of 340 primary school teachers in Northern Cyprus and identified that both theoretical and practical AI knowledge had an indirect effect on sustainable integration, only via teachers' beliefs and attitudes. Saharuddin et al. (2025) studied primary school teachers in Sabah, Malaysia, who had high overall scores for their AI-related TPACK, varying scores across TPACK domains by age.

Other research suggests that knowledge is also a factor in trust and awareness. In a study of 211 primary and secondary school teachers, Lucas et al. (2024) found that knowledge about AI was a strong predictor of trust in AI. However, when the AI knowledge was not present, the digital competence-trust relationship was not observed, indicating that there is a need for more than just general digital skills. Güneyli et al. (2024) conducted a survey of 164 teachers across primary, secondary, high school and university levels in Northern Cyprus and observed that demographic factors like gender, age, education and school type had no significant effect on AI awareness.

From Africa, evidence is sparse and is primarily from secondary or mixed level samples. A survey of 300 teachers across various levels in northern Ghana revealed that 37% of the teachers reported high or very high familiarity with AI, whereas 39.6% reported low or very low familiarity with AI, with a moderate level of self-efficacy (Iddrisu & Iddrisu, 2025). In South Africa, Ayanwale et al. (2024), when applying the extended UTAUT model, did not find that TPACK and AI ethics were significant predictors of preparedness for the use of AI, whereas technology integration, social influence, attitudes and SE were. In Namibia, factors that were correlated with intention to teach AI were perceived relevance, attitude, AI for social good and confidence among 159 in-service teachers while there was no correlation with AI anxiety and readiness (Jatileni et al., 2024). The results of the survey conducted by Kalinga and Ndibalema (2023) in Tanzania revealed that the technological competence, knowledge acquisition and competence

among secondary school teachers vary by education level but not age, gender or experience among the teachers. Likewise, teachers' knowledge acquisition was rated high whereas their knowledge deepening was rated low in two teachers' colleges (Lubuva et al., 2022).

These studies are all consistent that knowledge of AI is important for readiness, but vary in how directly it acts. Wang et al. (2023) and Lucas et al. (2024) report strong direct links between knowledge or cognition and other readiness outcomes, Kazmaci et al. (2025) found only indirect effects through beliefs and attitudes, and Ayanwale et al. (2024) found no significant effect of TPACK. This disagreement may be due to differences in how they are measured. The majority of these studies employed validated multi-item scales which were then analysed using structural equation modeling techniques, while Ghanaian study and the current study were self-report descriptive items. Samples are also different by level (primary, secondary or mixed) and by resources. That makes the 64.8% of teachers that reported having a basic understanding of AI not directly comparable to the 37% that reported high familiarity in northern Ghana as the items and response scales are different. What the studies have in common is that they are based on self-report, and thus reflect perceived rather than demonstrated knowledge. The same is the rationale for Objective 1 in the present study.

2.2.2 AI-Related Classroom Use, Digital Skills, Enabling Infrastructure and Institutional Support

The evidence of classroom use is largely positive, but is limited. Jiang et al. (2026) used a survey and primary school teachers' interviews to synthesize the research. They reported moderate to high levels of AI-related TPACK, and teachers reported that AI has the potential to enhance their lesson design, differentiation and representation of content, as well as concerns about ethics, developmental appropriateness and classroom management. Kamaghe (2026) used 120 secondary school teachers in Dar es Salaam and Dodoma to experiment with AI tools like ChatGPT and Grok in lesson planning, assessment and adaptive content, and found that teachers saw improvements in student engagement and performance, and that teacher workload decreased. These are positive findings but have been found in a controlled trial in secondary schools of two major urban centers and may not reflect reality in unsupported primary rural schools.

Research on digital skills and professional learning reinforces the need for ongoing, hands-on professional learning. Despite teachers' view on the importance of computers, Murithi and Yoo (2021) surveyed 351 primary school teachers in Kenya and showed that most teachers had only been trained in basic computer literacy and that the lack of appropriate facilities hindered the integration of the computer in the classroom. A systematic review of technology-related professional learning in LMICs has shown that continuous, context relevant professional learning has proven to be more effective than one-off, tool-specific professional learning (Hennessy et al. 2022). Another more recent systematic review of AI in K-12 education pinpointed pedagogical knowledge, positive attitudes, organisational support, and continuous professional development as the key areas for teachers' growth (Aravantos et al., 2026). Despite being not specifically for primary schools in Tanzania, the results of these reviews align with the Tanzania findings that the gap is between using ICTs to achieve basic skills and their pedagogical use (Lubuva et al., 2022).

The same studies keep appearing with regard to infrastructure and institutional support. In a phenomenological study of 15 secondary school teachers in four schools in Tanzania, Ngao and Sang (2024) concluded that PLCs can help with the integration of ICTs but were limited at macro, meso and micro levels. Lack of training and infrastructure for teachers were some of the major challenges in the application of AI in northern Ghana, with institutional support rated as moderate (Iddrisu & Iddrisu, 2025). Similarly, Ayanwale et al., 2024, also revealed that the social influence and technology integration factors predicted the preparedness in South Africa. The findings correspond with the facilitating-construct of UTAUT (Venkatesh et. al., 2003) but very few studies directly measured institutional support. The overall findings of the studies are similar with training and infrastructure being the most commonly cited challenges. They vary in the extent of the benefits they claim: trials and intervention studies report strong gains, while surveys of teachers working under regular conditions report more moderate gains. Almost all the evidence of use and benefits for classrooms comes in the form of self-reported, meaning that it reports perceived, not measured, effects.

This review shows three gaps. Second, the Tanzanian evidence regarding AI is secondary school evidence (Kamaghe, 2026) and the broader East African evidence is primary school evidence on ICT (Murithi & Yoo, 2021). The studies found in this review did not focus on AI familiarity, use and enabling conditions among primary school teachers in a rural district of Tanzania. Second, the majority of research examining teacher AI readiness are based on a single composite measure or examine the readiness from a structural perspective that may mask between domain differences. A domain by domain description like this one is better for planning and indicates the areas of support required. Third, there are only a few studies linking up survey data with teachers' own reports in primary schools, and the explanations for patterns reported are rarely discussed.

This study seeks to do so. In the case of primary school teachers in Muheza District Council, it refers to self-reported familiarity with AI and knowledge (Objective 1) and to reported use of AI in the classroom, digital competence, infrastructure and institutional support needs (Objective 2) of teachers, both through questionnaires and interviews. It also recommends approaches for scaling up AI adoption in primary education to the local context.

III. METHODOLOGY

3.1 Research Design

A mixed methods approach with a convergent, descriptive design (Creswell & Plano Clark, 2018) was adopted. Data were collected in the same period of fieldwork and analysed separately: quantitative data (questionnaire responses) and qualitative data (semi-structured interviews). The design was selected because the aims required two types of evidence: a questionnaire for the pattern of teachers' self-reported familiarity, use and enabling conditions; and interviews for teachers' own accounts of what AI means to them and what they need. The two sets of results were compiled into a common display (Fetters et al., 2013), and presented in Table 5. The design used was exploratory and descriptive. Did not test hypotheses or estimate causal effects.

3.2 Study Area

The study was carried out in Muheza District Council, Tanga Region, in north-eastern Tanzania. The district is largely rural, and ten primary schools, both public and private, took part. Most of the questionnaire respondents were from rural schools (Table 2).

3.3 Target Population

The target population was primary school teachers in Muheza District Council. The accessible population was the teachers working in the ten participating schools. Public school teachers made up most of the questionnaire sample (Table 2).

3.4 Sampling Procedures and Sample Size

Purposive sampling was used to select schools to gain access to the key primary school settings (Palinkas et al., 2015). The schools were all public except for 3 private schools. In these schools, teachers were conveniently sampled to participate in the study. This proved practical as resources for fieldwork in this largely rural district were limited, but limits the extent to which the sample can be representative of teachers in the district (see Section 4.6). The sample size was determined according to the number of teachers available and willing to participate – not by a sample size calculation. During the fieldwork no counts of teachers approached were recorded, therefore a calculation of response rate was not possible. This information should be documented in future studies in this setting to determine the possibility of response bias.

A total of 91 persons who completed questionnaires and 20 persons who participated in the interviews were included in the final sample. There is no indication in the fieldwork records whether the interview participants were part of the 91 persons who responded to the questionnaire or from a different group. This is not desirable, and is discussed in Section 4.6.

3.5 Data Collection Instruments and Procedures

Table 1 shows how each objective was linked to its key concepts, data sources and method of analysis.

Table 1

Alignment of objectives, key concepts, data sources and analysis

Objective	Key concepts	Data sources and items	Analysis
Objective 1: To establish the levels of self-reported AI familiarity and knowledge	Self-reported familiarity and knowledge; basic understanding, knowledge of AI tools, awareness of pedagogical use, benefits and risks	Questionnaire items K1 to K5 (Table 3); interview accounts of what AI is and how it works	Frequencies and percentages; thematic analysis (understanding of AI in the classroom)
Objective 2: To examine what teachers report about AI-related classroom use, digital skills, access to enabling infrastructure and institutional support needs	Reported classroom use (S1 to S4); perceived usefulness (S5, S6); self-rated digital skills (S7); internet access; institutional support needs	Questionnaire items S1 to S7 (Table 4) and the internet access item (Table 2); interviews on classroom applications, training and digital skills, infrastructure and institutional support	Frequencies and percentages; thematic analysis by domain; institutional support from interviews only

3.5.1 Questionnaire

The questionnaire comprised of two sections. The first collected seven demographic and contextual items: gender, age group, highest education, teaching experience, type of school, location of school and internet access. In this section of this questionnaire, internet access was assessed. 12 five-point Likert-type items were included in the second

part of the instrument. Five items (K1 to K5, Table 3) measured self-reported familiarity with and knowledge of AI, and seven items (S1 to S7, Table 4) measured reported use of AI, perceived usefulness and self-rated digital skills. The following basic understanding of the concept of AI was assessed by K1; K2 assessed knowledge of AI tools that can support teaching and learning; K3 assessed awareness that AI can support teaching and learning; K4 assessed awareness of possible benefits of using AI tools in the primary school classroom; and K5 assessed awareness of possible risks or challenges of using AI in education. The objects represent various facets of familiarity and awareness as perceived. They are not performance-based, and therefore do not reflect actual knowledge, but rather perceived knowledge. The quantitative items will thus be regarded as markers of different domains and not as a valid composite measure of readiness. Face and content validity of all the items of the questionnaire were checked prior to use. No record of the number and disciplinary background of the reviewers was kept and should be reported in future uses of the instrument. The questionnaire included no measure of institutional support because this was used to explore this area in the interviews.

3.5.2 Interviews

Semi-structured interviews were used to understand teachers' conceptions of AI, their experiences of using AI in education, and their concerns about and needs for AI adoption. The interview transcripts were numbered R1 to R20, and each participant code matches the transcript from which an extract was taken. Each interview extract in Section IV is followed by the participant code and the date, month and year of the interview. Procedures. Questionnaires and interviews were collected during the same period of fieldwork, between [July, 2026] and [August, 2026]. Participation was voluntary, and only teachers who agreed to take part were included.

3.6 Data Analysis

The data obtained from the questionnaires were analysed descriptively. Percentages and frequencies were presented for each answer choice. The options 'agree' and 'strongly agree' were reduced to 'agree' and 'disagree' and 'strongly disagree' were reduced to 'disagree'. Responses that are neutral are listed individually. Denominators and counts were compared to the demographic and Likert response tables. All Likert items had 91 responses. There were 90 valid responses to the age item, meaning that percentages of this item are based on 90. No inferential tests were performed and therefore differences between percentages was not described as statistically significant and relationships between respondents background characteristics and the outcome domains were not tested. Scale reliability, within-person consistency and associations between items were not explored as the quantitative data were only available in aggregated tables and not at the respondent level.

Interviews were thematised according to the following domains: understanding of AI in the classroom, classroom applications, AI training and digital skills, infrastructure and institutional support. No inter-rater reliability check was performed and a second coder was not involved. This is mentioned as a limitation in Section 4.6. The quantitative and qualitative findings were then combined within each domain and displayed together in a combined display (Table 5).

3.7 Ethical Considerations

Informed consent and voluntary participation were applied and authorities were contacted for permission. All the participants' confidentiality was observed throughout. The names of schools are omitted and participants in the interviews are only identified by codes (R1 to R20). The results and quotations are presented in a non-identifying way because only ten schools participated, and so teachers and schools cannot be recognised.

IV. FINDINGS & DISCUSSION

4.1 Profile of Respondents

The majority of the sample were male (67 of 91; 73.6%), experienced (59 of 91; 64.8% have over 10 years of teaching experience), and from rural public schools (87 of 91; 95.6% each). The majority of the respondents possessed a diploma (45.1%) or certificate (42.9%). Forty of 91 teachers (40.7%) reported having reliable internet access for teaching, and 38 reported they did not have reliable access (41.8%), and 16 reported they sometimes had reliable access (17.6%). These characteristics are relevant for interpretation as the sample is not representative of the national primary teacher population.

Table 2*Demographic profile of questionnaire respondents.*

Characteristic	Category	n	%
Gender	Male	67	73.6
	Female	24	26.4
Age group	Below 25 years	3	3.3
	25–34 years	27	30.0
	35–44 years	42	46.7
	45 years and above	18	20.0
Highest education	Certificate	39	42.9
	Diploma	41	45.1
	Bachelor's degree	9	9.9
	Postgraduate	2	2.2
Teaching experience	Less than 1 year	5	5.5
	1–5 years	13	14.3
	6–10 years	14	15.4
	More than 10 years	59	64.8
Type of school	Public	87	95.6
	Private	4	4.4
Location of school	Rural	87	95.6
	Urban	4	4.4
Internet access	Yes	37	40.7
	No	38	41.8
	Sometimes	16	17.6

Note. n = 91 for all characteristics except age group (n = 90; one missing response). Source: Author's field data.

4.1.1 Self-Reported AI Familiarity and Knowledge

There was a moderate to good agreement for the five self-report items from 58.2% to 82.4% (Table 3). For K1, 59 of 91 respondents (64.8%) said that they had a basic understanding of AI. 58.2% of K2, or 53 out of 91, agreed they were aware of AI that can help teaching and learning. The understanding of how AI can be used for teaching and learning (K3) was the highest with 82.4% (75 of 91). For example, K4 measured their awareness of the potential for AI to enhance primary school teaching and K5 measured their awareness of the potential for AI to present risks or challenges, and there was 75.8% (69 of 91) and 73.6% (67 of 91) consensus respectively. The rate of disagreement was low for all items (1.1% to 13.2%) and the neutral rate varied from 16.5% to 28.6%. The lowest agreement and highest disagreement between respondents were in regards to knowing certain AI tools (K2). These percentages are based on teachers' reports of familiarity and awareness. Are not objective tests of AI knowledge and are not a developed AI literacy score.

Table 3*Self-reported AI familiarity and knowledge items (n = 91).*

Item	SA	A	N	D	SD	Agree %	Disagree %
K1 I understand the basic meaning of artificial intelligence.	15	44	26	5	1	64.8	6.6
K2 I know different AI tools that can support teaching and learning.	11	42	26	8	4	58.2	13.2
K3 I am aware that artificial intelligence can be used to support teaching and learning.	36	39	15	1	0	82.4	1.1
K4 I am aware of the possible benefits of using AI in primary school teaching.	25	44	18	3	1	75.8	4.4
K5 I am aware of possible risks or challenges of using AI in education.	27	40	18	4	2	73.6	6.6

Note. SA = Strongly agree; A = Agree; N = Neutral; D = Disagree; SD = Strongly disagree. Agree % = SA + A; Disagree % = D + SD. Source: Author's field data.

The interviews revealed a wide range of views on what AI is. Some teachers made a clear separation between being familiar with the term AI and knowing how it works and how it could be used in teaching. R1 described this gap directly:

"I still do not have a deep understanding of Artificial Intelligence and how AI can be applied to teaching and learning in the classroom. I have heard about this technology, but don't have enough knowledge about what AI is, how it works and the benefits of using it in my work as a teacher in the classroom." (R1, 20 July 2026).

R20 expressed similar uncertainty and asked for more training to prepare for using AI in teaching (R20, [23 July 2026]). Other participants gave functional definitions, describing AI as machines carrying out tasks that normally need human intelligence and as a tool that helps with information processing and problem solving:

"Artificial Intelligence is a technology that allows the computer or the machine to carry out tasks that typically require human intelligence. These machines can process information, learn from the data already available and give answers based on the instructions they are given. In education, this technology can be used to enhance the way of teaching and learning." (R10, 23 July 2026).

A smaller number of responses described AI as something that extends human capacity and does not replace it:

The definition of Artificial Intelligence that is that, "Artificial Intelligence is a science and technology that can be used to simplify different tasks that are done by humans, in education, it can make the teachers and students ease to acquire the information, learn in different ways and solve different educational problems, it is designed to improve the human capacity." (R8, 20 July 2026).

Read together, these extracts show familiarity that is uneven and often tool-oriented, ranging from admitted uncertainty (R1, R20) to accurate functional definitions (R10). R8's account supports a limited claim that some participants saw AI as a support for, and not a replacement of, teachers' own professional judgement. That is a narrower claim than critical evaluation of AI outputs, which the interview data do not directly show.

Combining the findings from the questionnaire and interview, there is a moderate to high level of familiarity with AI, and the level of familiarity is uneven. More people were aware that AI could assist teachers (82.4%) and the benefits of AI (75.8%) or risks of AI (73.6%) were greater than having a basic understanding of AI (64.8%) or knowledge of AI tools (58.2%). Thus, broad awareness seems to be on the fore-front, before working knowledge of concrete tools. This pattern is useful in reading through the TPACK framework which can help distinguish technological awareness from pedagogical integration (Mishra & Koehler, 2006). Some interviewees were able to describe what AI is, or give examples of it being used, but others simply stated they required training to understand how to best utilise AI in the teaching profession. The results are similar to those of the previous studies conducted in Tanzania that reported low levels of ICT competence compared to its more pedagogical use (Lubuwa et al., 2022; Kalinga & Ndibalema, 2023). The present study thus contributes to the ongoing research in the field of digital education that has demonstrated that the use of technology and awareness of it does not automatically result in pedagogically oriented practice.

The results in some ways support the broader literature of AI and cannot be compared with it in other ways. The teacher's confidence and uncertainty in their use of the materials is similar to that reported in the northern region of Ghana (Idsusu & Idusu, 2025), and the three readiness clusters reported for Chinese primary school teachers (Wang et al., 2023), but the items and scales are too distinct to compare the percentages directly. The training requests made by R1 and R20 align with the AI knowledge being a precursor to trust and confidence (Lucas et al., 2024). The influence of knowledge on integration was seen to be largely through beliefs and attitudes by Kazmaci et al. (2025), and Güneyli et al. (2024) did not find demographic characteristics to explain awareness. This study did not measure attitudes nor test for differences between groups, so cannot confirm or challenge these findings.

The extent of the questionnaire also should be kept in mind. The Digital Promise framework is grounded in understanding, evaluation and use of AI (Mills et al., 2024) and the UNESCO framework has 5 dimensions of teacher competence (Miao & Cukurova, 2024). Only basic conceptual understanding, knowledge of AI tools, awareness of possible benefits, and awareness of possible risks or challenges are covered by the five items used here. The five items used here are only a subset of these domains: basic conceptual understanding, knowledge of AI tools, awareness of pedagogical applicability, awareness of possible benefits, and awareness of possible risks or challenges. They are self-reports, so they do not report knowledge of AI, rather a sense of familiarity and awareness. To answer Objective 1, the reported familiarity level for the five items had moderate to high levels across the items and conceptual depth was less consistent and should not be interpreted as competence.

4.1.2 Classroom Use, Digital Skills, Infrastructure and Institutional Support

Classroom use, perceived usefulness and self-rated digital skills. Classroom use S1 - S4, perceived usefulness S5 - S6 and digital skills self-rated S7 are reported in Table 4. There was no quantitative institutional support scale. Overall, 47.3% agreed that they use AI tools in teaching (S1). There was greater agreement for specific uses: developing teaching and learning activities (S2:51.6); explaining concepts (S3:63.7) and preparing assessments (S4:52.7). This was somewhat more positive as 59.3% said that they felt that AI had enhanced their teaching (S5) and 61.5% said that AI has enhanced learning outcomes (S6). These are perceptions and not measured effects on pupils' learning. Respondents were split regarding whether they possessed digital skills to use AI, with just over half saying they did (S7) and 22.0% saying they didn't.

Table 4*Reported AI use, perceived usefulness and self-rated digital skills (n = 91).*

Item	SA	A	N	D	SD	Agree %	Disagree %
S1 I use AI tools in teaching.	9	34	21	15	12	47.3	29.7
S2 I use AI to develop teaching and learning activities.	10	37	20	14	10	51.6	26.4
S3 I use AI to explain concepts.	21	37	19	8	6	63.7	15.4
S4 I use AI to prepare assessments.	13	35	24	13	6	52.7	20.9
S5 AI has improved my teaching.	17	37	23	8	6	59.3	15.4
S6 AI improves learning outcomes.	19	37	22	8	5	61.5	14.3
S7 I have the digital skills for AI.	12	37	22	10	10	53.8	22.0

Note. SA = Strongly agree; A = Agree; N = Neutral; D = Disagree; SD = Strongly disagree. Agree % = SA + A; Disagree % = D + SD. Source: Author's field data.

There are some patterns in Table 4 that warrant careful attention. There was a higher proportion of respondents who agreed with the specific item 'I use AI to explain concepts' (63.7%) compared to the broader item 'I use AI tools in teaching' (47.3%). This is not directly apparent in the aggregated data. A possible explanation is that some respondents answered the general item with a general-purpose digital tool that contains AI features (translation or search), but they answered the more specific item by using an AI-specific tool. This is not substantiated by any respondent-level records. With no individual data to compare, it is not possible to determine whether the pattern is due to how the items were interpreted, missing data, or inconsistency among respondents. The point is again taken up in Section 4.6.

The interviews elaborated on the questionnaire results to illustrate teachers' vision of implementing AI in the classroom. Participants shared their experiences creating teaching materials, constructing questions and exercises, providing explanations at various levels, and delivering differentiated instruction. R2 emphasised the development of learning materials:

"Artificial Intelligence can assist in creating different teaching and learning resources like pictures, drawings, stories, songs and educational videos that can make lessons more engaging and easier to understand for students." (R2, 28 July, 2026).

R3 focused on questions and assessment:

This technology can be used to make questions, answers, exercises and examinations more easily; it can also be used to assess and evaluate students' progress of varying levels of difficulty as per student's ability. (R3, 23 July, 2026).

R8 linked AI to differentiation:

"Artificial Intelligence can assist the teacher in developing content that is appropriate for students with different learning styles. For example, it can be useful for creating simple explanations for students who are struggling in understanding a specific topic, or for making activities based on each student's ability." (R8, 05 August, 2026).

These extracts show that teachers can describe practical uses of AI, mainly in preparing materials and assessments, which matches the reported uses in Table 4 (S2 and S4). They are phrased as what AI can do, however, and it is not clear from the interviews whether they describe current practice or expected use. Digital skills and training needs: Confidence in digital skills was mixed (Table 4, S7), and the interviews showed that the training teachers asked for was of two kinds: AI-specific knowledge and more general ICT skills. R1 asked for training in what AI is, how it works and how it can be used for teaching:

"I would need to be trained in Artificial Intelligence so that I can understand what it is, how it works and how it can be used in the teaching and learning process. Many teachers are still not given sufficient knowledge about this technology, and therefore there is a need for them to be given training that will enable them to use it correctly." (R1, 03 August, 2026).

Another participant argued that basic ICT competence has to come first:

"There is a need for teachers to be capacitated on the use of ICT in general before they start using Artificial Intelligence, as some teachers still have issues in knowing how to use computers, different programs and digital systems. ICT training will help give teachers a good foundation in understanding and using modern technologies in teaching." (R6, 05 August, 2026)

Overall, the extracts indicate a progression of needs, starting with fundamental ICT skills, then learning about AI, and culminating in the application of AI in teaching. They feel only just over half of teachers had the digital skills to use AI, which aligns with the questionnaire findings. Infrastructure and enabling conditions: Enabling conditions were not readily available. Few respondents had reliable access to the internet (40.7%) followed by none and only

sometimes (17.6%) (Table 2). Material conditions were consistently mentioned as barriers in the interviews, especially devices, internet connection and electricity. R12 connected the dots between the benefits of AI and equipment and connectivity.

Artificial Intelligence can be used with ICT equipment, such as computers, laptops, smart phones and tablets. Teachers will need adequate equipment and a robust internet infrastructure within schools to take advantage of the use of Artificial Intelligence. (R12, 03 August, 2026).

R6 added that a reliable power supply is a precondition for using digital devices at all:

“In addition to the internet, a reliable power supply is needed in order to operate the ICT devices required for the implementation of Artificial Intelligence in the school. If schools do not have adequate and/or permanent electricity they will have problems using computers, tablets, and other digital devices. Therefore, addressing the electricity infrastructure of schools is an important issue in preparing for the application of Artificial Intelligence.” (R6, 8 July, 2026).

The interview accounts and the internet access figures point the same way. In a predominantly rural sample, the facilitating conditions of UTAUT are a major perceived constraint. Institutional support: The interviews were the only method used to explore institutional support. Training and infrastructure were discussed with participants, relating it to equity and stating that support should not exacerbate the rural/urban divide. They also requested for coordinated support, equality of training with stakeholders, and collaboration with stakeholders (Table 5). Institutional support is not measured here but instead is reported as a qualitative finding, as there was no quantitative scale.

The findings on Objective 2 reflect a positive view of the value of AI but with some caution on how to use it. Approximately 60% reported improvements in learning outcomes and/or their teaching as a result of AI, with some benefits cited in the interviews including engagement, efficiency, and personalised support. This is consistent with the benefits that secondary school teachers in Tanzania (Kamaghe, 2026) and primary school teachers in China (Jiang et al., 2026) have perceived. However, the present study was based on teachers' perceptions. It made no use of pupil achievement information, classroom observation/experimental evidence, or demonstrated AI's effects on teaching quality or learning outcomes. This is a significant boundary, as the utility of AI in the field of education is reliant on the tool, its implementation, and the context. It also suggests that the trial results that are reported in Kamaghe (2026) should not be extrapolated to Muheza based on these data.

The training needs that participants reported are consistent with the general literature regarding professional development needs. Primary school teachers in Kenya also reported mainly receiving basic computer literacy training (Murithi & Yoo, 2021), with reviews of low- and middle-income countries and reviews of K-12 systems showing a preference for ongoing, relevant professional development over sporadic professional development workshops (Hennessy et al., 2022; Aravantinos et al., 2026). The participants' depiction of a continuum from basic ICT skills to understanding of AI and its application in the classroom is also aligned with the UNESCO framework, which illustrates a sequence of competences from foundations to pedagogical competencies and professional development (Miao & Cukurova, 2024). Training for Muheza would thus require a basic digital competence as needed, an understanding of AI basics, critical evaluation, ethics, and subject-specific pedagogy and supported practice.

The results of the infrastructure are consistent with the part of UTAUT called facilitating conditions, but cannot be interpreted as a test of the UTAUT model. The majority (59.3%) did not have access to reliable internet, while interviewees frequently mentioned electricity and devices as restrictions on use. Murithi and Yoo (2021), in Kenyan Primary Schools, and also Ngao and Sang (2024) in Tanzania and secondary school teachers in northern Ghana (Iddrisu and Iddrisu, 2025), have reported similar constraints in their respective countries, specifically, secondary school teachers using AI. Most of these studies measure institutional support and equity as a factor. This topic is also important because interviewees raised concerns about the rural-urban divide, which may affect the impact of training and equipment.

Tanzania now has national guidance on digital education and AI in education (MoEST 2026a, 2026b). The results indicate that a new national AI policy is not needed. They also highlight the importance of ensuring that the 2026 guidance on use is communicated, resourced, implemented, and monitored in schools and teacher education. The findings are particularly applicable to the implementation in a highly rural and public school sample.

4.2 Integration of Quantitative and Qualitative Findings

Table 5 combines the two strands into a single table by domain. The joint display provides a clearer picture than juxtaposing 'high knowledge' and 'low preparedness'. For this sample, the level of familiarity with AI was moderate/high for some items and generally teachers described AI as potentially useful. Classroom use and digital self-confidence/reliable internet access were less consistent. The interviews also highlighted the need for training, devices, electricity, connectivity, and institutional support. A fair reading is that readiness will differ across the domains.

Table 5
Joint Display Integrating Quantitative and Qualitative Findings

Domain	Quantitative evidence	Qualitative evidence	Integrated interpretation
AI familiarity/ knowledge	58.2%–82.4% agreement across the five self-report items.	Accounts ranged from uncertainty to functional definitions and recognition of human judgement.	Self-reported familiarity is substantial for many teachers, but conceptual depth is uneven and should not be equated with objective competence.
Classroom AI use	47.3% general use; 51.6%–63.7% agreement for selected specific uses.	Teachers described material creation, assessment support, explanation and differentiation.	Teachers can articulate practical uses, but reported adoption is not uniform across specific tasks (see Section 4.3.1 for a discussion of the S1/S3 discrepancy).
Perceived usefulness	59.3% said AI had improved teaching; 61.5% perceived improved learning outcomes.	Interviewees described engagement, efficiency and personalised support.	Perceived usefulness is relatively positive, but the study does not measure causal effects on teaching quality or pupil outcomes.
Digital skills	53.8% agreed that they had the digital skills for AI.	Participants requested foundational ICT and AI-specific training.	Self-confidence is mixed and professional-development needs remain prominent.
Infrastructure	40.7% reported reliable internet; 41.8% no reliable access; 17.6% sometimes.	Participants emphasised devices, internet and electricity.	Facilitating conditions are a major perceived constraint, especially in this predominantly rural sample.
Institutional support	Not directly measured with a quantitative institutional-support scale.	Participants requested coordinated support, equitable training and stakeholder collaboration.	Institutional support is a qualitative finding and should not be presented as a quantitatively measured domain in this dataset.

4.3 Implications for Training and Policy

The principal practical implication of the findings was training. Participants didn't just want exposure to AI. For some, the journey moved from learning basic ICT skills to understanding AI and its classroom applications. This aligns with the literature on professional development in LMC countries, which acknowledges the importance of continuous, context-specific support over a workshop approach (Hennessy et al., 2022), and with the UNESCO competency framework (Miao & Cukurova, 2024). Teachers in Muheza should therefore be trained in basic digital competence, AI basics, critical evaluation of AI, ethics, subject-specific pedagogy, and supported practice, complemented by infrastructure improvements that enable teachers to practice.

V. CONCLUSION & RECOMMENDATIONS

5.1 Conclusion

This exploratory study aimed to evaluate the level of knowledge and readiness among primary school teachers in Muheza District Council, regarding the use of AI. There is no national-level conclusion on the readiness of teachers to incorporate AI in schools as the data does not suffice for this. They do indicate that there is uneven preparedness of the sampled schools' teachers. While a significant number of teachers knew about AI and were very positive about its potential for learning, others were less consistent with general use, their self-assessed digital competence, and having easy access to stable internet. This was complemented by the interviews, which indicated variations in conceptual understanding and a high perceived need for hands-on training, devices, connectivity, electricity, and institutional support. The primary takeaway is that awareness is not sufficient. Pedagogical skills, critical analysis of AI outputs and enabling conditions are also essential for a responsible classroom integration.

5.2 Recommendations

The following recommendations are based on the evidence from this study and on the Tanzanian policy setting at the time of writing. They are prioritized according to the level of action required, and do not delay small projects until the completion of large infrastructure projects. School leaders should design a realistic environment that gives teachers opportunities to learn, such as protected time for professional learning, peer groups, and locally formed professional learning groups, which are not reliant on new buildings. The core concepts of AI, ethical and critical evaluation of AI, subject specific pedagogy and responsible human supervision should be integrated into existing in-service training that is offered by the Tanzania Institute of Education (TIE) and teacher education providers and the materials should be able to be taught offline where internet connectivity is not available.

The Ministry of Education, Science and Technology and its implementing agencies should ensure that the 2026 National Guidelines for Artificial Intelligence in Education and the National Digital Education Guidelines for Schools and Teacher Colleges are communicated, resourced, implemented, and monitored, with a focus on rural primary schools.

Professional development should not be a single event, but rather district and local government planners should determine that their infrastructure aligns with the support required for professional development (reliability in connectivity, electricity and shared or individual digital devices).

Declaration of Interest

The authors declare that they do not have any known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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