Teachers' technological competencies in enhancing teaching and learning in secondary schools in Tanzania

Tumaini Kalinga[1], *Placidius* Ndibalema[1]

[1]*University of Dodoma, Department of Educational Foundation and Continuing Education, 1 Benjamin Mkapa Rd, 41218 Iyumbu, Dodoma, Tanzania*

Abstract. The purpose of this study was to investigate level of teachers' technological competencies and the effect of teachers' age, gender, educational level and teaching experience in relation to their technological competencies they hold. Questionnaires were used to collect the data from 139 teachers from selected schools using simple random and purposive sampling procedures. Descriptive and inferential statistics were carried out using SPSS software version 23. The study found that majority of teachers were at the first level of technological competency (KA). It was also found that there was significant difference between teachers' level of education and technological competencies they hold. However, the study found that there is no significant difference between teachers' gender, age and working experience and technological competencies they hold at p-value of 0.05, though there were some variations. The study recommends that provision of training among teachers should focus on uplifting teachers from KA level to another levels.

Keywords: technological competencies, teaching, learning, digital inequalities

1. Introduction

The use of technology in the 21st century has increased significantly in in all activities of human being education system. The global initiatives such as Sustainable Development Goals (SDGs) places Information and Communication Technology (ICT) as a hub for providing quality education. It is stated that by 2030 all learners are to be taught by well-qualified, trained, adequately remunerated and motivated teachers, using appropriate pedagogical approaches and supported by appropriate ICT [17]. According to Miao et al. [33] ICT integration in teaching and learning is a key element towards the provision of quality and relevant education. Also, todays' education system prioritizes the development of skills required in the 21st century which focuses on learner's needs such as collaboration, creative and competence [43]. Today's generation has high level of technology literacy in which most learners are digital natives [22]. In order to cope with the changing digital native learning environment and meet the 21st century skills, teachers need to have a range of competencies, including critical thinking, problem solving, creativity, meta-cognition, communication, digital and technological literacy, civic responsibility, and global awareness [24].

Literature points out that teachers play a very essential role in the management of learning, and thus, they should be competent in using the modern technologies in teaching and learning practices [49]. Therefore, the effective integration of ICT in teaching and learning process requires teachers who have technological competencies [25]. Hence, teachers need to be technologically competent for effective ICT integration in teaching and learning practices. Teachers' technological competencies are fundamental factors for effective ICT integration in teaching and promoting active learning [3, 20].

Successful teachers' ability to integrate ICT in teaching and learning activities is depending on various factors. Komba and Mwakabenga [25] identify the internet connectivity as one of the key factors which can enable the teachers to get connected through different communication networks and participate in self-directed learning and thus, they can search for, and share, learning materials, which can be used to enhance their knowledge, skills, and competences. Likewise, the study by Lin et al. [26] indicate that data literacy is a significant predictor for teachers' digital teaching competence. Other literature emphasizes the need of organizing training programs to strengthen technological skills among teachers, adequate resources and updated infrastructure which play a key role in the effective integration of technology in educational practices [1, 48].

While the factors identified by some researchers are crucial in using ICT for pedagogical purposes, there are still large disparities in teachers' technological competencies levels caused by several problems such as inadequate use of digital content in teaching and learning [55]. Most sub-Saharan countries for example have been witnessing the prevalence of digital gaps among teachers in secondary schools due to several reasons. Some reasons include under-qualification, minimal training in ICT and low familiarity with digital learning [28]. Further evidence indicates that the availability of electricity, computers and internet in schools for pedagogical purposes is very minimal in most sub-Saharan countries [34]. For instance, only 33.8% of primary schools have access to electricity while the same holds true for 57.2% of upper-secondary schools in the region [34]. In some countries like Nigeria, the findings indicate lack of ICT strategies and policies, poor internet connectivity, electricity, and a high poverty level as the primary drivers of digital gaps in remote communities [44]. Further studies point out the lack of appropriate leadership and administrative support on guidelines, training on the pedagogy of ICT to be among the challenges for facilitating teaching and learning in sub-Saharan Africa [7]. Other reports outline lack of access to infrastructure and digital devices, teacher trainers with requisite digital skills, outdated teacher training curricula, limited financing for continuous professional development (CPD) and reluctance on the part of some teachers to take up technology to facilitate learning to be some limitations [14].

Tanzania is among the sub-Saharan countries which has introduced the framework for teachers on integration of ICT in teaching and learning with the emphasis on the pedagogical purposes [55]. Despite the establishment of the framework on digital skills, there are potential gaps in implementation. Most teachers have limited awareness on the potential of ICT as a tool for self-directed professional development [25]. Some primary schools (mostly private) and public secondary schools in urban areas, have facilities with access to desktop computers, laptops, calculators, telephones, printers, scanners and video cameras, but the use of such devices for pedagogical purposes depends on individual teachers' interests, knowledge and skills, school policy and access to the internet [29]. Likewise, the studies by Mtebe and Raphael

[35, 36] revealed that teachers among secondary schools have minimal use of digital content in their teaching that can support students for acquiring 21st century skills due to insufficient ICT facilities, unstable internet connection and low level of ICT competence and skills.

Evidence indicate that even teacher educators who are responsible to prepare secondary school teachers lack ICT competencies. It has been reported that most experienced teacher educators lack digital skills as their programs have little focus on ICT as a pedagogical tool [4, 27]. Young and inexperienced teacher educators show readiness in using ICT, but inadequate facilities, time shortage per period, and the vast teaching load were the main challenges, thus, they rarely integrate ICT in their teaching [39, 54]. The logical implication is that teaching continues to run in traditional learning methods instead of utilizing a more interactive ICT-based learning. One would say, it is difficult to enable the learner to think beyond the four walls of the classroom due to existing technological challenges which lead to teachers' digital incompetence. While global and national initiatives are emphasizing on teachers' technological competencies to achieve the 21st century skills, there is little evidence regarding teachers' ICT competencies while reflecting on demographic variables. Thus, this study, examined the relationship between teachers' demographic variables and their technological competencies for integrating ICT in enhancing teaching and learning in Tanzania.

1.1. Teachers' demographic variables and ICT integration in teaching and learning

Research draws attention to a number of demographic variables that are correlated with teacher use of ICT in teaching and learning process. Different scholars have attempted to analyze the relationship between teachers' use of ICT in teaching and learning activities and their demographic characteristics such as gender, age, and level of education as well as teaching experience. Gender, educational level and working experience [41], gender [9, 15, 20, 37], and educational level [3].

Demographic variables are among the factors demonstrated effective use of ICT in teaching and learning practices. For instance, a study by Niem, Veriña and Alcantara [41] in Philippines studied on teaching and learning with technology, found that majority of respondents were female teachers, bachelor degree graduates and are below 15 years of working compared to male teachers. Again, the study conducted by Dinçer [15] revealed that both male and female teachers had knowledge and skills on using ICT in teaching process. Almerich et al. [3] studied on teachers Information and Communication Technology Competences in Spain. It was found that university teachers have more technological competencies compared to primary teachers. This was because university teachers who have bachelor degree level and master level and are frequently use computers in both offices and home places.

Ghavifekr and Rosdy [20] in Malaysia studied on teaching and learning with ICT tools. It was found that the use of ICT devices in classroom by male teachers was higher than female teachers. In sub-Saharan countries studies by Buabeng-Andoh [9] studied on factors that influencing teachers' pedagogical use of ICT using 376 participants from 24 public and private schools in Ghana. It was found that female teachers are more using ICT in their teaching than male teachers. Moreover, teachers were using ICT in basic and traditional activities like searching information and class representation. In Tanzania [37] studied on teachers' attitudes towards

the use of ICT as pedagogical tools. It was found that both male and female teachers had positive attitudes toward ICT use as a pedagogical tool but the level of integrating ICT in teaching was slight due to low level of technological knowledge and skills.

1.2. Global overview on digital inequalities in teaching and learning process

Digital inequalities refers to the differences in knowledge and skills among teachers in access and using ICT in teaching and learning practices. According to UNESCO-UIS, only 64% of primary and 50% of secondary teachers have received minimum training on the use of ICT in sub-Saharan Africa [34]. This indicates that the integration of ICT in teaching activities among sub-Saharan countries is not effective. The study conducted by Mendonça, Crespo and Simões [32] revealed that high level of inequalities especially in terms of ability for using basic ICT facilities are influenced mostly by age, educational level and employment situation. Where by male teachers who had access to ICT tools and young older are more likely to have high competencies in using ICT in their teaching practices compared to those who are elder and not have access to ICT facilities. Also, Asongu et al. [5] found that internet access in school environment has impact on teachers' competencies for using ICT in teaching practices in day to day activities.

While the study by Rundel and Salemink [50] asserts that there is the digital inequalities among rural school in terms of availability of ICT equipment's, network connectivity and teachers competency. Most teachers found in rural areas schools have low tendency in using ICT in teaching and learning practices due to various constrains like poor internet connections and inadequate ICT facilities. Furthermore, in Belgium study by Duroisin, Beauset and Tanghe [16] found that during COVID-19 pandemic there was various factors contributed to digital inequalities among teachers in using ICT in teaching and learning practices such as availability of technological equipment's and level of education. The availability of ICT equipment's in school and home environments influence teachers to integrate ICT in their teaching practices hence improve their technological competencies.

Moreover, the study conducted by Nueva [42] in Philippines exposed that teachers are using technology in classroom for instructional support, information referencing as well as communication and communication platform among others. However, their competencies in using ICT in those activities varies due to digital competency gap. While, perception and attitude of teachers towards the use of ICT in teaching activities plays countless role in building technological competencies. This was revealed by the study conducted by Akram et al. [1], Peled and Perzon [46] who found that teachers with positive perception and attitude towards the use of ICT in teaching activities are more likely to have high level of technological competencies compare to those with negative attitudes.

1.3. Theoretical background: consideration of Technology Acceptance Model (TAM)

The TAM model which was developed by Davis [13] in 1989 seeks to identify what influences the adopters of certain technology to accept or reject the application of technology in different practices such as in teaching and learning. The model predicts the use and acceptance of

information system and technology by individual users. TAM model suggests that people try new system basing on two main factors which are perceived usefulness and perceived ease of use. Perceived usefulness refers to the degree that someone believes that using a particular technology system will improve job performance [13]. Perceived ease of use are believes that one can think using a particular technology requires little effort [6]. This implies that, many teachers believe that in order to integrate ICT in teaching and learning process requires to have certain technological competencies and without having those competencies they cannot integrate ICT in their teaching and learning activities. This has been revealed by the study conducted by Ekberg and Gao [18] focused on challenges of consuming ICT in teaching and learning. The results revealed that majority of teachers have positive knowledge, skills, attitudes and beliefs in integrating ICT in teaching and learning. Therefore, the model act as an internal predictor for technology use among teachers in teaching and learning practices, this model lies on it is views that, internal factors such as perceived usefulness and perceived ease of use aredeterminant of an individual decision towards the adoption, acceptance and rejection of technology in teaching and learning.

1.4. Research questions

1. What are the level of teachers' technological competencies in enhancing teaching and learning in secondary schools?
2. What is the effect of teachers' gender, age, educational level and working experience on their technological competencies? Four hypotheses were formulated to guide the resolution of the second research question

2. Methods

2.1. Research design

The current study adopted survey research design. According to Creswell [12] survey research designs are procedures in quantitative study in which researcher administer a survey sample to describe the attitude, opinions, behavior or characteristics of the studied population. Furthermore, survey research design allows the researcher to collect to collect information from a sample that has been drawn from a pre-determined population at just one point in time. The meaning of data are interpreted by relating results obtained from statistical test back to past research studies.

2.2. Participants

The population of this study was public secondary school teachers in the Dodoma region of Tanzania. In all 139 teachers were randomly selected for the study. the composition of the 139 participants was as follows; 66 (47.5%) males and 73 (52.5) female, 84.9% aged between 25-44 years and 15.1% above 45 years; 60.5% were below 10 years working experience and 39.5% were above 10 years' experience; 61.8% had bachelor degree, 21.6% had diploma, 13.7% had mater degree and 2.9% had postgraduate diploma. While Purposive sampling procedures were used to obtain public secondary schools with ICT infrastructures.

2.3. Research instrument and measures

The instrument used to collect data from the respondents was questionnaire which was made up of two parts with the first part composed respondents' demographic information such as gender, age, working experience as well as educational level. The second part of the questionnaire was adopted the UNESCO ICT Competency Framework for Teachers in preparing questions [56]. The ICT CFT contained three level which was Knowledge acquisition (KA) this is the first level of teachers' technological competency where by the teacher is acquiring knowledge about using technology and have all ICT basic competencies. At this level teachers should be aware of potential benefit of ICT in the classroom. Knowledge deepening (KD) this is the second level of teachers' technological competency where by the teachers acquire ICT competencies that enable them to facilitate learning environment that are student centered, collaborative and cooperative in nature. Knowledge creation (KC) this is the third and last level of teachers' technological competency. At this level teachers should be able to design, modify and implement classroom practices that supports national goals. Teachers should be able to integrate ICT across subject content, teaching and assessment activities. The framework has six aspects which are understanding ICT in education policy, curriculum and assessment, pedagogy, application of digital skills, organization and administration as well as teacher professional learning. Therefore, the questionnaire contained three parts respectively to levels. Therefore, each level had its own part and questions in the questionnaire. All the items on the questionnaire were measured on five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Validity of the questionnaire was ensured by expert appraisal where by before going to the field a lot of improvement have been made based on the expertise comments from ICT courses instructors. Reliability of the questionnaire was ensured by using Cronbach alpha for scale data to check the internal consistency in each level. The analysis indicates Cronbach alpha of .966 for KA level, .977 for KD level and .974 for KC level. The Cronbach alpha for the overall ICT CFT levels was .972 which shows that the questionnaire was reliable to measure the internal consistency of data. The questionnaires for the main study were personally administered by the researcher to the teachers in their schools. All participants were given 3 to 5 days to complete the questionnaire. Finally, all 139-questionnaire administered were found appropriate for the analysis.

2.4. Data analysis

Descriptive statistic and Spearman Rank correlation coefficient were conducted to answer the formulated research questions. Before data analysis data were tested for normality. The study used Kolmogorov-Smirnov to test data normality since our sample size was above 100. The result in table 1 below indicate that data was not follow normal distribution since p-value (Kolmogorov-Smirnov test) is less than **0.05** for the three levels (KA, KD, and KC), hence non-parametric framework was employed for analyzing data.

3. Findings

This study aimed at investigating teachers' technological competencies levels and the relationship between teachers' technological competencies and their demographic variables specifically

Table 1
Tests of data normality.

Level	Kolmogorov-Smirnov			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Mean KA	0.14	139	0.000	0.911	139	0.000
Mean KD	0.10	139	0.003	0.975	139	0.012
Mean KC	0.08	139	0.021	0.979	139	0.033

Table 2
Correlation (Spearman rank correlation) analysis of field data.

			Median KA	Median KD	Median KC
Spearman's rho	Median KA	Correlation coefficient	1	.567**	.421**
		Sig. (2-tailed)	.	0.00	0.00
	Median KD	Correlation coefficient	.567**	1	.733**
		Sig. (2-tailed)	0	.	0
	Median KC	Correlation coefficient	.421**	.733**	1
		Sig. (2-tailed)	0.00	0.00	.

** Correlation is significant at the 0.01 level (2-tailed).

by age, gender, educational level and working experiences. Table 1 indicates teachers' technological competencies levels and figure 1, 2, 1 and 4 indicates the relationship of teachers' technological competencies and their gender, age, educational level and working experience.

3.1. Level of teachers' technological competencies in enhancing teaching and learning

The first objective was to investigate teachers' technological competencies levels in enhancing teaching and learning. To find out teachers' technological levels the study used Spearman rank correlation as shown in the table 2.

The study used Spearman rank correlation for the median values. Median was used because data are skewed and not normal distributed. The study findings indicate that there is a strong positive correlation between KA and KD levels, KD and KC levels, as well as KA and KC levels. From table 2, KA and KD has 0.567, which is strong positive correlation, KD and KC appear to have a superior positive correlation 0.733 compared to KA and KD. However, KA and KC are the only pairs with a moderate positive correlation 0.421. The probable cause is that it is hard for teachers to create knowledge which is not yet fully acquired in the previous levels. On the other hand, KD and KC show a very strong positive correlation because teachers with knowledge deepening competencies can easily create new knowledge. This implies that a majority of secondary school teachers have technological competencies at knowledge acquisition level (KA) which was the first level.

3.2. The effect of teachers' gender, age, educational level and working experience on their technological competencies in teaching and learning process

This was the second study objective, where by in order to find out the effect of teachers gender, age, working experience and education level the following null hypotheses were formed.

3.2.1. Ho1: There is no relationship between teachers' technological competencies and gender

Table 3 below indicates that between male and female teachers there was no significant difference in technological competencies they hold in integrating ICT in teaching and learning process at all levels. Though data presented in figure 1 indicates some variation between technological competencies whereby male teachers were more competent than female teachers. Moreover, the findings in figure 1 indicates that both male and female teachers had technological competencies in all levels. Nevertheless, variations in teachers' technological competencies they hold existed in each level was not significant. For example, the study found that at KA level technological competencies were 80% for male and 78.5% for female; KD level were 69.3% for male and 67.5% for female and at KC level 58.9% were for male and 58.6% for female. This implies that gender had no effect in teachers' technological competencies for using ICT in teaching and learning process rather there is variation where by male teachers were more competent than female teachers. This is due to the fact that male teachers are working hard in using ICT facilities compared to female teachers who think themselves are weak.
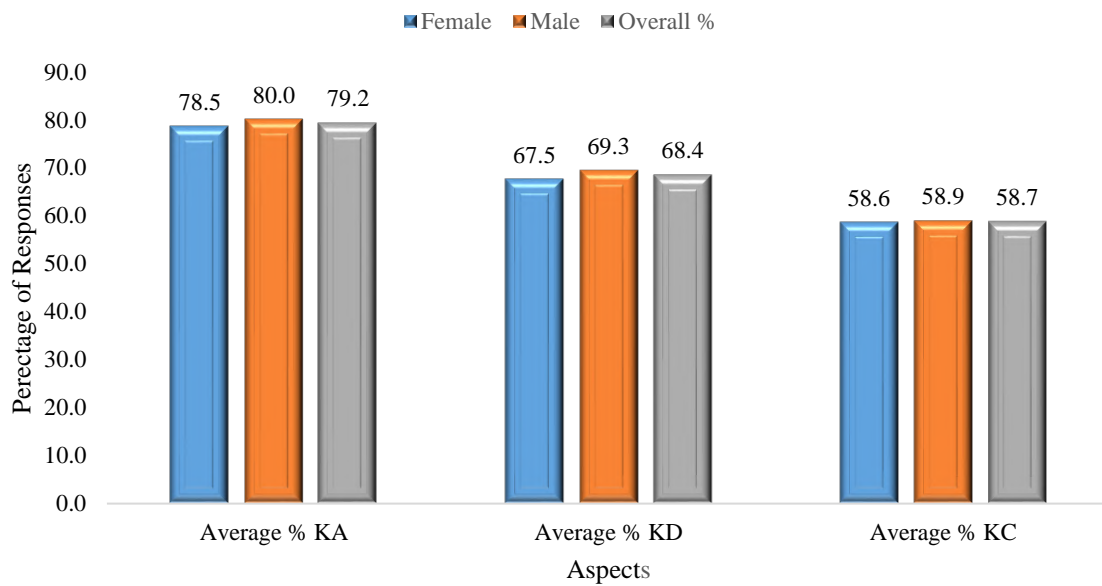

Figure 1: Relationship between teachers' technological competencies and gender.

The study conducted further statistical test for the levels by gender using Mann-Whitney U [38]. The hypotheses tested are indicated in the table 3.

Table 3
Mann Whitney U hypothesis testing for gender.

Null hypothesis (H_0)	Sig.	Decision
The distribution of Median KA is the same across gender	0.381	Retain the H_0
The distribution of Median KD is the same across gender	0.548	Retain the H_0
The distribution of Median KC is the same across gender	0.802	Retain the H_0

Results from table 3 indicate that there is no enough evidence to reject the null hypothesis. Hence, we conclude, at 0.05 level of significance, the median distributions for KA, KD and KC are the same across gender.

3.2.2. Ho2: There is no relationship between teachers' technological competencies and education level
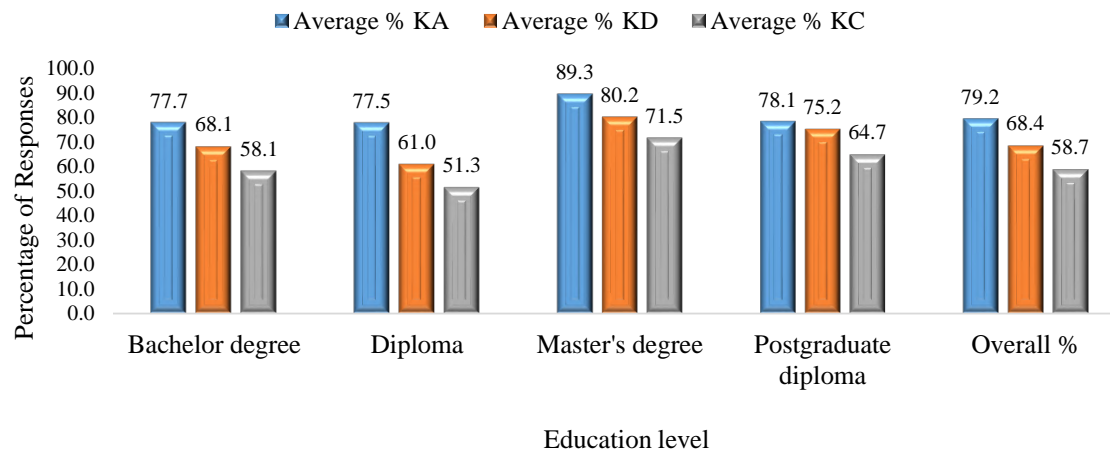

Figure 2: Relationship between teachers' technological competencies and education level.

Figure 2 above indicates that there is significant difference between teachers' level of education and technological competencies they hold in integrating ICT in teaching and learning process. The study found that the higher educational level the higher technological competent teachers are they. For instance, for KA level it was found that 77.5% had diploma, 77.7% had bachelor degree, 78.1% had postgraduate diploma and 89.3% had master degree. This implies that the technological competencies of teachers at diploma level is different with teacher who have bachelor degree or master level. Moreover, in KD level teachers' technological competencies for ICT integration in teaching and learning process were not slightly the same across all educational levels. The study found that 61% had diploma, 68.1% had degree, 75.2% had postgraduate degree and 80.2% had master degree. Furthermore, for KC level teachers' technological competencies for integrating ICT in teaching and learning process vary across education level. The study found that 51.3% had diploma, 58.1% had bachelor degree, 64.7% had postgraduate diploma and 71.5% had master degree. Therefore, in KC level there is the difference of technological competencies

teachers holds in each educational level. This implies that technological competencies that teachers have at KA level was not the same to KD and KC level specifically to their level of education. The overall percentage at KA level was 79.2%, for KD level was 68.4% and for KC level was 58.7%. This indicates that the higher the level of technological competences the lower the technological competencies among teachers. Majority of teachers at all educational level have high technological competencies at KA level but the technological competencies among teachers slightly decreases at KD level in all education levels. Also, in KC level there are few teachers who have technological competencies at this level. Moreover, across all level of technological competencies, teachers who had master degree are more competent in integrating ICT in teaching and learning process.

A further statistical analysis was performed to justify this observation from figure 2, this time around Kruskal-Wallis test is appropriate since we have more than two levels of education [8] and the same revealed that the claim is actually true (table 4).

Table 4
Kruskal-Wallis test for educational level.

Null hypothesis (H_0)	Sig.	Decision
The distribution of Median KA is the same across categories of educational level	0.05	Reject H_0
The distribution of Median KD is the same across categories of educational level	0.002	Reject H_0
The distribution of Median KC is the same across categories of educational level	0.029	Reject H_0

From table 4 above, we have no enough evidence to retain the claim "KA, KD, and KC is the same across levels of education", and conclude that the distribution of medians KA, KD and KC, each, differs across categories of educational level.

3.2.3. Ho3: There is no relationship between teachers' technological competencies and age categories

Figure 3 indicates that teachers' technological competencies is not the same across all age categories in KA, KD and KC levels. The study found that at all level teachers aged between 25-49 years have more technological competencies for using ICT in teaching and learning process followed by teachers aged between 50 years and above. Furthermore, the study found that teachers aged between 60-64 years have low technological competencies for using ICT in teaching and learning activities. This implies that younger teachers are more connected and engaged to technology than elder teachers. Also, this can be caused by a lot of efforts made by the government's and other educational stakeholders in providing training to teachers on how to integrate ICT in teaching and learning activities as well as ICT infrastructures in secondary schools are furnished and installed now days at wide range compared to past days.

Furthermore, the study found that teachers aged between 25-49 years had more technological competencies at KA level followed by KD level and minority of teachers are at KC level. Therefore, teachers age may influence technological competencies that teacher holds. A further statistical analysis was performed to justify this observation from figure 3, again this time around Kruskal-Wallis Test was appropriate since we have more than two age categories [8] and the same revealed that the claim is actually true (table 5).
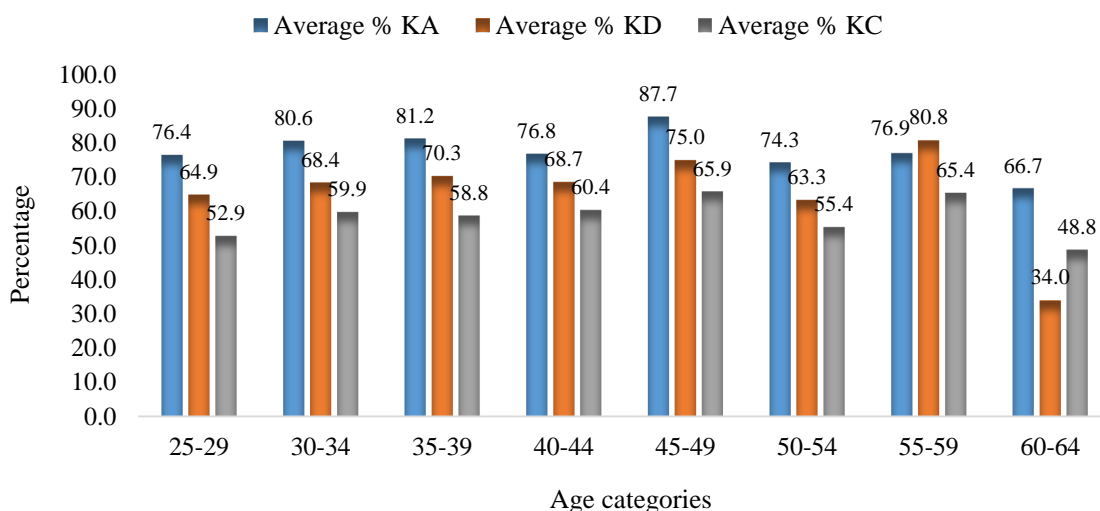
Figure 3: Relationship between teachers' technological competencies and age categories.

Table 5
Kruskal-Wallis test for age categories.

Null hypothesis (H_0)	Sig.	Decision
The distribution of Median KA is the same across categories of age	0.18	Retain the H_0
The distribution of Median KD is the same across categories of age	0.08	Retain the H_0
The distribution of Median KC is the same across categories of age	0.85	Retain the H_0

From table 5 since the p-values are greater than the level of significance 0.05 it can be concluded that teachers' technological competencies at KA, KD and KC levels is the same across all age categories. Hence, we have no enough evidence to reject the null hypothesis.

3.2.4. Ho4: There is no relationship between teachers' technological competencies and working experience

Figure 4 indicates that teachers' technological competencies for using ICT in teaching and learning process varies across years of working. It was found that teachers working experience between 5-15 years have more technological competencies than others. For instance, in KA level, the study found that teachers with 5-9 (80.4%) working years' experience have more technological competent than teachers with below 5 (77.2%) years' experience. Moreover, the study found that teachers with more than 25 years' experience have low technological competencies for using ICT in enhancing 21st century skills in public secondary schools. While at KD level teachers with 15-19 (74%) years' experience have more technological competences than others. Also, the study found that in KC level teachers with 15-19 years' experience have more technological competencies than others. Moreover, the study found that teachers with 5-19 years' experience have more technological competencies at KA level followed by KD and KC level respectively. This implies that application of technology in education has been

increased now days compared to past days, also the generation of 21st century is connected to technology than other centuries. This led to teachers prepared employed currently to had more technological competent than those who were prepared before technology revolution. Figure 4 indicates the variation of teachers' technological competencies across three levels.
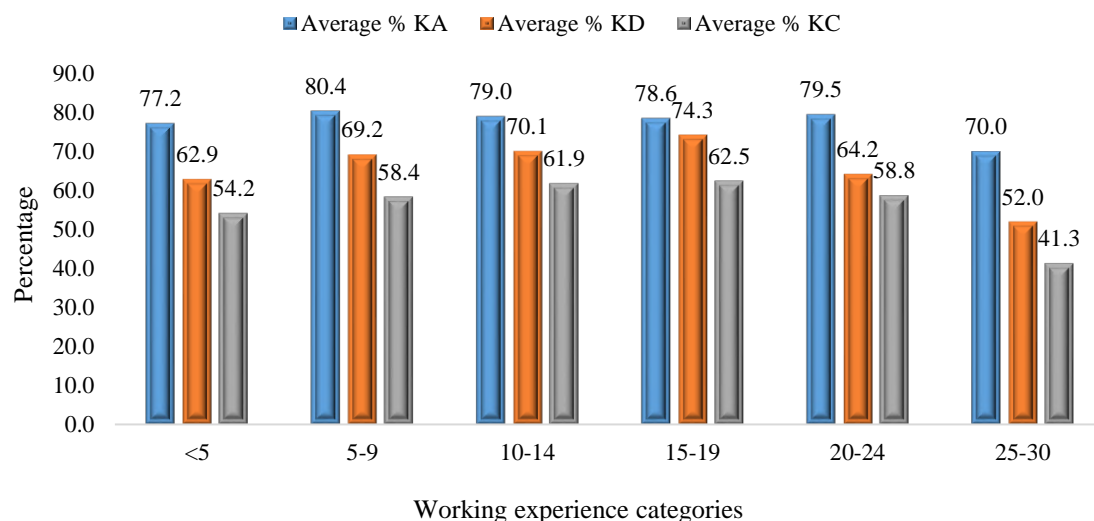

Figure 4: Relationship between teachers' technological competencies and working experience.

A further statistical analysis was performed to justify this observation from figure 4, again this time around Kruskal-Wallis test was appropriate since we have more than two working experience groups [8] and the same revealed that the claim is actually true (table 6).

Table 6
Kruskal-Wallis test for for age working experience.

Null hypothesis (H_0)	Sig.	Decision
The distribution of Median KA is the same across categories of working experience	0.85	Retain the H_0
The distribution of Median KD is the same across categories of working experience	0.20	Retain the H_0
The distribution of Median KC is the same across categories of working experience	0.45	Retain the H_0

It can be concluded that at level 0.05 level of significance, from table 6, since the p-value are greater than the level of significance such as 0.05, there is no significant statistical difference between teachers working experience and their technological competencies they hold across all level. Therefore, teachers' technological competencies at KA, KD and KC level is the same across working experience, hence we have no enough evidence to reject the null hypothesis.

4. Discussion

This study found that majority of teachers are at KA level of technological competencies and this is due to various factors like insufficient ICT trainings, easy access and availability of ICT

facilities in school environment. Moreover, teachers in secondary schools preferred to use basic computer application in preparing lesson plans, lesson notes and presentations. For that reason, it is hard for teachers to be competent in KD and KC level because these levels requires teachers' creativity in using ICT in teaching and learning. These finding aligns with the study by Caluza et al. [11], in Philippines, who made an assessment of teachers ICT competencies in teaching and learning practices. Teachers had basic knowledge on using ICT in their teaching and learning. They used technology in some activities which required minimal technological competencies with basic knowledge like searching materials, preparing lesson notes and other related activities. Again, Ngwenya and Pelser [40] conducted a study on teachers ICT competencies in educational organizations. It was revealed that teaches have moderate ICT competencies in integrating ICT in teaching practices. A majority of teachers use ICT in their personal activities rather than implementing the curriculum. Likewise, these study findings are similar to those of Mtebe and Raphael [35, 36], in Tanzania, who studied teachers' competence level for the attainment of the 21st century skills. It was found that many teachers had moderate self-reported confidence in all Technological Pedagogical and Content Knowledge (TPACK).

The present study revealed that gender has no significant difference on teachers' technological competencies in integrating ICT in teaching and learning process. Though, the study found that male teachers had more technological competencies in using ICT in enhancing teaching and learning than female teachers. Consistent with other study [51], male teachers perform slightly better than female teachers in using digital skills in teaching practices. Furthermore, the study revealed that gender seems to be a good predictor of ICT skills among teachers. In the same line the study finding are in agreement with Ghavifekr and Rosdy [20] who found that the use of ICT devices in classroom by male teachers was higher than female teachers. Contrary to the current study, gender had no effect to both male and female teachers technological competencies in integrating ICT in teaching practices [15, 21, 37].

Likewise, the study findings by Niem, Veriña and Alcantara [41] and Buabeng-Andoh [9] reveal that female teachers have more technological competencies in integrating ICT in teaching activities than male teachers. The variations between male and female teachers in terms of ICT pedagogical competence as revealed in the currents study could be explained by TAM model, which emphasizes the adoption or acceptance of technology depends on perceived usefulness and ease in teaching and learning. Based on the TAM model individual factors may contribute to the under-utilization of technology for teaching based on how teachers accept/reject technology based on their perception [53]. This is an indication that when planning for enhancing teachers' capacity in integration of ICT as a pedagogical tool, the consideration of literacy and ICT acceptance may be crucial. It also sends the message that the consideration of individual factors when designing the professional development programs on ICT integrations would certainly add values in strengthening teachers' ICT pedagogical competences.

The present study found that there was a difference in teachers' technological competencies in enhancing teaching and learning across levels of their education. Similar findings could be reflected in the study by Almerich et al. [3] who found that university teachers have more technological competencies compared to primary teachers because they have bachelor degree and master degree and frequently use computers in both offices and home places. This could imply that, teachers with high level of education seems to have high technological competencies in using ICT in teaching activities than teachers with low level of education. Contrary to

Guillén-Gámez et al. [21] who found that educational level of teachers had no effect on teachers' digital competencies in using ICT in teaching activities.

The current study revealed that teachers' technological competencies in enhancing teaching and learning was not the same across age categories. These study findings of teachers age categories are in agreement with the study by Mazoya, Ismail and Mnyilizu [30] who revealed that teachers below 35 years old were more technologically competent than teachers above 35 years old. Furthermore, the findings are contrary to the findings by Semerci and Aydin [52] who found that teachers technological competencies are not influenced by neither age or gender. Similar findings were reported by Wanjiru et al. [57] who revealed that majority of teachers disagreed that younger teachers were more competent in using ICT in teaching and learning activities.

The present study revealed that teachers' technological competencies in using ICT in enhancing teaching and learning varies across years of working. This is in line with Al-Furaih and Al-Awidi [2] who found that teachers with moderate level of teaching experience 5-10 years are reported to be strong in using technology. Ozudogru and Ozudogru [45] also found that male teachers with teaching experience between 16-20 years perceived to have high level of technological knowledge than those with working experience between 1-5 years. This implies that teachers with more teaching years seems to have more technology competencies as compared to those with less teaching years. Although the demographic variables appear to influence ICT competence, further evidence indicate other factors such as the availability and accessibility of ICT facilities, computer self-efficacy, school leadership support, training and attitude. The study by Buabeng-Andoh [10] in Ghana revealed that school leadership support and accessibility of ICT facilities related to teachers ICT integration in teaching practices. Therefore, the effective ICT integration in schools needs school leadership support in different ways like encouraging teachers to continue using ICT in their activities. Also, this was confirmed by the study conducted in Tanzania by Kafyulilo, Fisser and Voogt [23] who found that encouragement of school management are essential factor for teachers to integrate ICT fully in teaching activities. The availability and accessibility of ICT facilities such as computers, laptops, projectors and printers attract teachers to use ICT in their activities. Studies by Peled and Perzon [46], and Pozas and Letzel [47] revealed that ICT attitude among teachers influenced ICT usage in teaching activities. Teachers with positive attitude towards ICT integration are more likely to have high competencies than those with negative attitudes. The study by Lin et al. [26] also indicates that ICT attitude among teachers had no significant impact towards technological competencies they hold. The study by Menabò et al. [31] revealed that high self-efficacy among teachers increase level of confidence in using ICT in teaching activities. Computer training among teachers also predicts the level of technological competencies that teachers holds. The study by Esfijani and Zamani [19] revealed that teachers with relevant training are more likely to utilize IC effectively than those without training.

5. Conclusion and recommendations

The study concluded that majority of teachers in public secondary schools are at the first level of technological competency (KA) regardless of their demographic variables. The study

concluded that educational level had positive impact on teachers' technological competencies. Though age categories, gender and working experience had no significant impact on teachers' technological competencies to enhance teaching and learning but there is some variation. Male teachers are more competent than female teachers, teachers aged between 25-49 years are more competent in using ICT than teachers above 50 years and teachers below 10 years of working had more technological competencies compare to those with above 10 years working experience. We are in the century where many students are digital natives of which they might have better technological skills than their teachers. There are some technological solution for teachers already but still, many schools are limited technological infrastructures, facilities and expertise. These may compromise teachers' competencies in integrating technology in teaching. Undoubtedly, teachers' capacity and technological environment in schools needs to be strengthened. Strengthening teachers' capacity in ICT integration regardless of their gender, age and teaching experience has the potential in enhancing teaching and learning and uplift the from the first level (KA) to other levels like KD and KC. The study provides insights about teachers' levels of pedagogical competencies in integrating ICT in teaching and learning. It has significant implications to educational stakeholders who may need to know demographic factors such as age, level education, gender and working experience may influence teachers' ICT pedagogical competencies. It is possible that these findings may enhance better understanding in prioritization of ICT based capacity building programs for teachers while reflecting on the demographic variables. The scope of this study limited to teachers' demographic variables (gender, age, educational level and working experience) in relation to technological competencies in enhancing teaching and learning process. Further studies could be conducted involving larger sample size and other mediating factors such as school leadership, teachers' beliefs and curriculum on how they could predict teachers' pedagogical competencies in integration of ICT teaching and learning.

Acknowledgments

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