Student Teachers' Perceptions of Training and Support in their Preparation for Digital Age

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Abstract
The study examined student-teacher perceptions and satisfaction with the strategies adopted in their preparedness to use digital technology as a pedagogical tool. Specifically, the study focused on the strategies included in the Synthesis of Qualitative Evidence (SQD) model. The study used a quantitative research approach and descriptive-correlational design. Through the self-developed questionnaires, the data were collected from 462 university student teachers in Tanzania. Data were analysed through descriptive and inferential statistics. The findings show that teachers as "role models" and "peer collaborations" were the most frequently used strategies in pre-service teacher education for educational technology use. The least well-frequently used strategy was "instructional design" and "continuous feedback". Perceived SQD model training strategies were statistically significantly associated with age group and subject area of specialisation. Finally, gender has a statistically insignificant effect on perceived SQD model training strategies. Based on the findings, it is recommended that in order to improve student teachers' training and the ICT integration in teacher education, learning by design and continuous feedback mechanisms should be strengthened.

Keywords: *Digital age, ICT, student teachers, digital teaching competencies, pre-service teacher education*

Introduction

The integration of information and communication technologies (ICT) in educational systems is a universal agenda (OECD, 2019; UNESCO, 2015) and a critical cornerstone to fostering desired pedagogical transformations (Ndibalema, 2020; Starkey, 2020; Tondeur et al., 2012). Recognising the critical function of teachers as change agents, fostering ICT competencies in both pre-service and in-service teachers is a driving force behind technology-enhanced educational reforms (Khedkar & Nair, 2016; Starkey, 2020; UNESCO, 2018). This means that student-teachers should be prepared with

professional digital competencies so as to serve as role models and catalysts for pedagogical transformation (Tondeur et al., 2012). The implication here is that student teachers will graduate with the necessary pedagogical competencies in ICT. However, evidence indicates that support in terms of developing student teachers with ICT pedagogical competencies is lacking (Mtebe et al., 2021; Ngao et al.,2022).

There are sets of local and international ICT competency frameworks for teachers (UNESCO, 2018). However, training teachers for educational technology use largely remains below expectations (Instefjord & Munthe, 2017; Ndibalema, 2020; Tondeur et al., 2017) and it is still a challenging endeavour (Tondeur et al., 2021). Large-scale studies also indicate that student-teachers feel inadequately prepared for educational ICT use in their programmes. The Teaching and Learning Survey (TALIS), for example, revealed that more than 50 per cent of teachers reported that they were incapable of using technology as a pedagogical tool (OECD, 2019). Again, on average, 44 per cent of the teachers reported competencies in relation to technology-based teaching inclusively embedded in their formal training (OECD, 2019). Inadequate teacher training is often related to the technological centric approach (technical know-how) rather than how to use technology in teaching and learning (Koehler & Mishra, 2009; Tondeur et al., 20I7), thus lacking an integrated approach. This results in teachers' failure to play their central roles as role models, curriculum (designers), and transformative agents. Another identified reason is that student teachers experience limited collaborative, authentic, and reflective learning opportunities in integrating ICT into their teacher education courses (Tondeur et al., 2012). The training strategies that teacher education institutions can adopt to support student-teachers' ICT integration has been noted by several researchers (Kay, 2006; Pinto-Santos et al., 2022; Tondeur et al., 2012). There is evidence to suggest that a microlearning environment can significantly affect student-teacher training to integrate technology into their future classroom (Tondeur et al., 2012; Tran et al., 2020).

In Tanzania, studies focusing on preparing student teachers for educational technology use are mostly limited to an inquiry of one or two strategies (Kafyulilo et al., 2015). Previous studies have examined the relationship between demographic factors and ICT-related constructs such as attitudes and perceived usefulness (Danner & Pessu, 2013; Jiménez-Hernández et al., 2020; Pozas & Letzel, 2023; Tondeur et al., 2016; Tzafilkou et al.,2021; Soh, 2020). The findings from such studies are heterogeneous and do sometimes complement each other. For example, Tzafilkou et al. (2021) reported that male student teachers had a higher level of self-determination in terms

of learning about the pedagogical use of ICT. Similarly, Pozas and Letzel (2023) claimed that males had greater positive attitudes toward the usefulness of ICT in teaching and learning, and they are more likely to take personal initiatives to learn about the pedagogical use of ICT. Additionally, Jiménez-Hernández et al. (2020) study established a gender-related gap in the application of ICT tools and resources, that ICT is more utilised by males than their counterparts. Bridging the gender gap in ICT competencies and usage requires affirmative interventions, such as campaigning against gender stereotypes and fostering environments where both boys and girls can develop confidence and skills in ICT. There is also an alternative perspective, as some scholars contend that in relation to competencies and ICT uses in education, the gender-based differences are insignificant. For instance, in Belgium, Tondeur et al. (2016) found an insignificant effect of age and gender on student-teachers' acquisitions of ICT pedagogical competencies and their intentional use. Similarly, Danner and Pessu (2013) and Soh (2020) found that gender did not significantly predict the uses of ICT among the student-teachers. In addition, a study among Malaysian student-teachers by Arumugam (2011) found that gender had no effect on ICT perceived usefulness and ease of use.

Studies such as Tarhini et al. (2014) and Sánchez-Mena et al. (2017) found that there is a significant association between age and teachers' learning and intention to use ICT in their future teaching. In these studies, the age factor was found to moderate the effect of social and psychological factors, including perceived ease to use, perceived usefulness and subjective norms. In particular, the perceived ease of using ICT was more positive among younger teachers and less positive among older teachers (Sánchez-Mena et al., 2017). The findings suggest a generational gap that can affect student-teachers learning about the integration of ICT in teaching and learning. Studies on the development of ICT pedagogical competencies are extensive, but the impact of subject specialisations on student teachers' perceptions of training and support is under-explored. Few available studies in this area focus on sciences and mathematics, overlooking other areas of subject specialisations. For example, Kisalam and Kafyulilo (2011) examined factors affecting learning and teaching with ICT in science and mathematics in teacher education. It was found that inadequate ICT skills among lecturers and poor facilitative conditions affect the development of science student teachers' ICT pedagogical competencies. Similarly, Kafyulilo and Keengwe (2014) examined ICT's pedagogical use among science teachers. The results revealed that science teachers' applications of ICT as pedagogical tools are at a very minimal level. Likewise, Kafyulilo et al. (2015) investigated how science teachers' ICT pedagogical competencies develop. It was found that

strategies such as collaborative design, role modelling and the availability of an expert are key determinant factors. Scholars argue that the effectiveness of technology integration in classroom settings may partly depend on how teachers and student-teachers are trained (Mtebe et al., 2021; Mouza et al., 2014; Agyei & Voogt, 2011).

Agyei and Voogt (2011) point out that no matter how modern technologies and curricula are if teachers are incompetent in integrating available technologies in their teaching and learning, the cherished pedagogical affordance of ICT will not be fully realised. This includes their ability to integrate technology into teaching, assessment, communication, and reporting. Therefore, the evolving questions of how student teachers perceive and conceptualise the key delivery strategies in their journey of preparedness to use and teach with digital technologies become crucially important. This study is an attempt to address this concern. The study answered two main research questions: what are the key training strategies perceived by student-teachers as being provided in their training to use digital technologies in teaching and learning? And two, what influence do the student-teachers' demographic variables (gender, age group, and subject specialisations) have on perceived support and training strategies provided in their preparedness to use digital technologies in teaching and learning? Understanding the strategies adopted in teacher education to prepare digitally competent teachers provides insights into the effectiveness of strategies currently employed to train student-teachers to use ICT as a pedagogical tool. This aligns well with the current educational transformation landscape.

Theoretical Framework

The present study was informed by the SQD model (Synthesis of Qualitative Data) (Tondeur et al., 2012) of the strategies for technology integration in teacher education. The model defines twelve key themes for strategies that prepare student-teachers to integrate technology into teaching and learning in classroom settings. The model (Figure 1) consists of inner and outer parts with six themes/strategies each. The strategies in the inner part involve role models, collaboration, authentic experiences, reflection, and feedback. The in outer part is about the institutional level (e.g., technology planning and leadership, access to digital resources, and staff development).

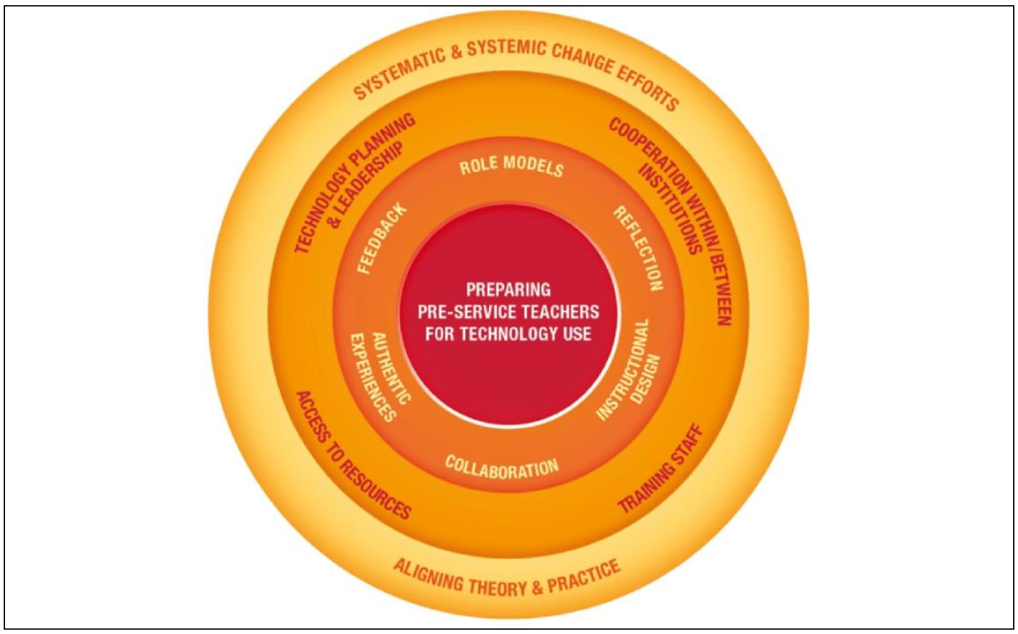

Figure 1: SQD Model to Prepare Pre-service Teachers for Technology Use (Tondeur et al., 2012*)*

According to the SQD model, the six strategies found in the inner part are essential in establishing the micro-learning environment required to prepare student-teachers for technology use (Tondeur et al., 2012). In order to explore student teachers' perceptions about the extent to which different strategies are integrated into their professional technology training, the present study adopted six strategies included in the inner part of the SQD model. Using teacher educators as role models (strategy 1) refers to the extent to which teacher educators are demonstrating best practices in using technology as a pedagogical tool (Lai, 2015; Tondeur et al., 2016).

It involves teacher-educators' seamlessly integrating digital tools and resources into lectures, enabling student-teachers to observe good examples related to effective technology integration into the teacher training process. Though teacher educators often provide some degree modelling related to educational technology use, the empirical study suggests that ICT training is sometimes inadequate (Admiraal et al., 2017; Instefjord & Munthe, 2017). In the present study, student-teacher perceptions in relation to using teacher educators as role models were assessed in terms of observed examples of ICT use in an educational setting and the concrete demonstration use of ICT in education. The role of reflection on ICT integration in education (Strategy 2) is associated with observing, discussing, and reflecting upon the appropriate use of educational technologies (Tondeur et al., 2016). Reflecting on

technology in education allows student-teachers to appreciate the usefulness and value of incorporating technology in a specific learning context (Mouza et al., 2014).

This could further cultivate and deepen student teachers' abilities to use ICT in their specific content and instructional strategies. In this particular strategy, the assessed aspects were perceived as giving opportunities to reflect on the role of ICT in education and identify challenges of ICT integration in teaching and learning. Learning how to use technology by design (Strategy 3) is understood as providing student teachers with opportunities about learning to teach with ICT by (re) designing teaching and learning materials. Learning technology by design is perceived by scholars (e.g., (Kafyulilo & Fisser, 2019; Mouza et al., 2014; Tondeur et al., 2016) as a promising strategy in the training of student-teachers with less prior knowledge. In the present study, the perceptions of student teachers with respect to this strategy were captured through their perceived support in their preparation of ICT-integrated lesson plans, and developing educational materials.

Strategy 4 involves the process of student-teachers working together to develop competencies for the pedagogical use of ICT (Hao & Lee, 2017). It also includes sharing experiences and collaboration in preparing and implementing technology-integrated content delivery and instructional strategies (Kafyulilo & Fisser, 2019). The scaffolding of authentic technology experiences (Strategy 5) is associated with the process of providing step-by-step support and guidance to student teachers as they engage in technology-led real teaching and learning experiences. Engaging student teachers in teaching and learning activities that mirror technology integration in real teaching and learning experiences is a powerful strategy for linking theoretical knowledge and practices (Valtonen et al., 2015). Student teachers' perceptions of scaffolding authentic technology experiences as a strategy for technology integration were captured through several aspects.

These include giving opportunities to test different ways of using ICT in real classroom situations, using ICT during teaching practices, and encouraging the use of ICT in an educational setting. The last strategy involves ongoing and process-oriented feedback in student teachers' learning journey to use and teaching with ICT (Valtonen et al., 2015). It is a powerful strategy, especially in promoting learning progress and identifying areas for improvement. It empowers student-teachers to become lifelong learners. Student teachers' perspectives related to this strategy were explored based on aspects such as perceived feedback about the pedagogical use of ICT, timely assessments of their ICT competencies, and ICT integration.

Methodology

Research Approach and Design

The investigation was framed under a quantitative research approach (Creswell, 2015), and a cross-sectional descriptive study was adopted. The choice of quantitative approach was influenced by the desire to understand student-teacher's perceptions, which can be quantified and analysed statistically from the deductive approach (Noor et al., 2021). Furthermore, the study was cross-sectional and descriptive in nature because it aims to systematically describe the specific characteristics of a particular population at a single point in time (Creswell & Guetterman, 2019).

This aligns with the current study objective: to evaluate the student teachers' perceptions about ICT training strategies. Understanding ICT training strategies as perceived by student teachers at a single point of time is valuable for documenting their existing training and support and identifying some aspects that require improvements or further learning. The study was conducted at the University of Dodoma, College of Education (CoED), Tanzania. CoED offers a range of three-year university-based teacher education and bachelor's degree programmes in natural science and social science subjects. It also prepares teachers to teach at various levels of education (i.e., pre-primary schools, primary schools, secondary schools and teacher colleges based on Tanzania's curriculum. Student teachers had taken information technology courses in the first year of their degree, and the focus had been on generic ICT skills, but not on the educational uses of those skills. In addition, in the second year, student-teachers are introduced to an overview of educational media and technologies and examples of how they could be used for teaching.

Participants

The participants were 462 student teachers in their final year of teacher preparation. Student teachers in their third year are at a crucial stage in their ICT teaching competencies development, and they can provide focused insights into key training strategies linked to learning to teach with technology. Of the total number of participants, 150 (32.47%) were females and 312 (67.53%) were males. The inclusion of gender in this study was informed by the influence of gender on a broader context of ICT integration in education (Weidlich & Kalz, 2023).

A gender-sensitive approach is important in understanding the nuanced differences in ICT training experiences (Jiménez-Hernández et al., 2020; Weidlich & Kalz, 2023). As for the age group, 11(2.4%) were from 16 to 20 years old, 299 (65.28%) from 21 to 25 years old, and 148 (32.31%) were 25

years old and above. This is an important factor in understanding the familiarity of the learners with technology, including their perceptions (Güngörenet al., 2021). Individual perceptions about ICT may vary across their disciplines (Tay & Lim, 2015). A total of 399 (86.36%) were from social science subjects, and only 63 (13.64%) were specialised in natural science subjects.

Table 1: Survey Participant Distribution by Sex, Age and Area of Specialisation

Variable		Total Frequency	%
Gender	Female	150	32.47
	Male	312	67.53
Age	16 -20 years old	11	2.40
	21 - 25 years old	299	65.28
	Above 26 years old	148	32.31
Subject areas of specialisation	Social science subjects	399	86.36
	Science subjects	63	13.64

Data Collection

Data were collected through questionnaires based on the SQD-scale developed by Tondeur et al. (2016). The primacy of the SQD-scale is the strategy included in the inner circle of the SQD model (Tondeur et al., 2012). The SQD scale provides an instrument which can be used to evaluate student teachers' perceptions of the degree of experienced support and training in their learning to teach with technology. As earlier noted, the inner part of the SQD-scale covers the six training strategies (Table 2). The questionnaire consisted of 24 items on a 6-point Likert scale that ranges from 1(Totally Disagree) to 6 (Totally Agree), distributed in six dimensions: role modeling (from items 1 to 4), reflection (from items 5 to 8), instructional design (from items 9 to 12), collaboration (from items 13 to 16), authentic experiences (from items 17 to 20), and feedback (from items 21 to 24).

Table 2: SQD Scale Sample Items

SQD strategies	Sample item
Role modeling	"The potential of ICT use in education was demonstrated concretely"
Reflection	"I was given a chance to reflect on the role of ICT in education"
Instructional design	"We learned how to thoroughly integrate ICT into lessons"
Collaboration	"Students helped each other to use ICT in an educational context"
Authentic experiences	"I was encouraged to gain experience in using ICT in a classroom setting"
Feedback	"I received sufficient feedback on how I can further develop my ICT competencies"

For the quantitative data collection process, the questionnaire was constructed in a Google Forms application, which facilitated a virtual survey. The targeted participants were informed about the study objectives, their consent was requested, and their participation was voluntary. By applying WhatsApp messenger, student-teachers were invited to participate virtually and fill in the provided questionnaire. The Google Forms link was shared in various groups of which the targeted participants were members. The procedures had an approximate duration of one week, and after guaranteeing 462 responses, the access to the survey was closed.

Data Analysis

In terms of quantitative data, descriptive and inferential statistics were performed to describe the demographic variables and to answer research questions on participants' perceptions of the ICT training and support included in an inner part of the SQD model. Descriptive statistical central tendencies and multiple linear regression analysis were performed.

Reliability Test

A confirmatory test analysis was performed to check the reliability [i.e., the consistency of each domain of the SQD model training strategies (see Table 3)].

Table 3: Reliability Test

Variables	# Items	Cronbach Alpha
Role model	4	0.801
Reflection	4	0.777
Instructional design	4	0.834
Collaboration	4	0.868
Authentic experiences	4	0.834
Feedback	4	0.905

Each domain had a Cronbach Alpha greater than 0.75, indicating high reliability of the survey tool used. This suggests that the items within each variable have a high level of internal consistency, making them reliable measures for assessing the respective constructs (Pallant, 2020). In order to ascertain the relationship between subscales of SQD model training strategies, correlation coefficient analysis was performed between six subscales. The findings revealed a positive correlation, suggesting that one domain of perceived SQD training strategies increases and other aspects also tend to increase. This indicates that all six training strategies incorporated in the SQD model are interconnected. Furthermore, the Pearson correlation coefficient had a value greater than 0.75, thus exhibiting a very high correlation (Pallant, 2020). Fundamentally, a value between 0.5 – 0.74 is a

high correlation and all values less than 0.5 are less correlated (Pallant,2020). Since all Pearson values of analysed variables range from 0.535 to 0.753, therefore, all the perceived SQD training strategies are highly correlated. Moreover, since all the p-values are less than 0.05, then, all the correlations are statistically significant.

Table 4: Correlations among Perceived SQD and its Subscales

Variable	1	2	3	4	5	6
1. ROL	1					
2. REF	0.606<.0001	1				
3. DES	0.670<.0001	0.714<.0001	1			
4. COL	0.629<.0001	0.694<.0001	0.753 <.0001	1		
5. AUT	0.595<.0001	0.643<.0001	0.693 <.0001	0.730 <.0001	1	
6. FEE	0.535<.0001	0.563<.0001	0.683 <.0001	0.667 <.0001	0.733 <.0001	1

Note: ROL Role modelling, REF Reflection, DES Instructional design, COL Collaboration, AUT Authentic experience, FEE Feedback; *** p < .001 all these are inferential statistics

Findings

Perceptions of the Key SQD Training Strategies

Although student teachers had generally positive perceptions towards all six SQD model training strategies, they do not feel particularly adequately supported in designing instructional materials that incorporate digital technologies (M=4.56; SD=1.15) or received continuing feedback, for example, on how they can further develop ICT competence (M=4.50; SD=1.28). Therefore, feedback and instructional design stand out as the domains of the SQD model training strategies with the least applications in this analysis. Yet, student-teachers acknowledged that teacher educators are strongly acting as role models by providing good examples of ICT practice to inspire ICT integration in teaching and learning (M=4.92, SD=1.02). Again, they were provided with collaborative opportunities to promote learning from and encourage each other about ICT integration (M=4.76, SD= 1.12). Therefore, the role model and collaboration stand out as the domains of the SQD model training strategies with the highest applications in this analysis.

Table 5: Perceived SQD Model Training Strategies Incorporated in Learning to Use Digital Technologies in Teaching and Learning

	Totally disagree N((%)	Disagree N(%)	Slightly Disagree N(%)	Slightly Agree N(%)	Agree N(%)	Totally Agree N(%)	Mean±StD
Role Model							
ROL1	8(1.76)	12(2.64)	5(1.10)	40(8.81)	227(50.00)	162(35.68)	5.10±1.00
ROL2	9(1.97)	32(7.02)	75(16.45)	0(0.00)	221(48.46)	119(26.10)	4.64±1.32
ROL3	11(2.42)	26(5.71)	52(11.43)	0(0.00)	204(44.84)	162(35.60)	4.86±1.30
ROL4	15(3.29)	19(4.17)	83(18.20)	0(0.00)	224(49.12)	115(25.22)	4.63±1.32
Overall Role	4(0.87)	8(1.74)	32(6.96)	73(15.87)	203(44.13)	140(30.43)	4.92±1.02
Reflection							
REF1	17(3.72)	40(8.72)	14(3.06)	69(15.10)	199(43.54)	118(25.82)	4.63±1.34
REF2	10(2.18)	21(4.59)	6(1.31)	51(11.14)	220(48.03)	150(32.75)	4.97±1.12
REF3	35(7.64)	59(12.88)	20(4.37)	60(13.10)	178(38.86)	106(23.14)	4.32±1.57
REF4	26(5.65)	46(10.00)	20(4.35)	65(14.13)	214(46.52)	89(19.35)	4.44±1.42
Overall REF	6(1.30)	13(2.83)	45(9.78)	87(18.91)	207(45.00)	102(22.17)	4.70±1.09
Instructional design							
DES1	32(7.00)	52(11.38)	20(4.38)	71(15.54)	195(42.67)	87(19.04)	4.33±1.49
DES2	17(3.73)	42(9.21)	15(3.29)	62(13.60)	210(46.05)	110(24.12)	4.61±1.34
DES3	28(6.11)	79(5.24)	24(5.24)	74(16.16)	175(38.21)	78(17.03)	4.14±1.53
DES4	12(2.64)	29(6.37)	16(3.52)	52(11.43)	226(49.67)	120(26.37)	4.78±1.21
Overall DES	4(0.87)	30(6.52)	43(9.35)	102(22.17)	189(41.09)	92(20.00)	4.56±1.15
Collaboration							
COL1	24(5.25)	56(12.25)	22(4.81)	66(14.44)	198(43.33)	91(19.91)	4.38±1.45
COL2	13(2.85)	18(3.95)	19(4.17)	43(9.43)	220(48.25)	143(31.36)	4.90±1.17
COL3	16(3.50)	36(7.88)	18(3.94)	66(14.44)	203(44.42)	118(25.82)	4.66±1.31
COL4	16(3.49)	27(5.90)	12(2.62)	52(11.35)	232(50.66)	119(25.98)	4.78±1.23
Overall COL	8(1.74)	17(3.70)	32(6.97)	79(17.21)	208(45.32)	115(25.05)	4.76±1.12

	Totally disagree N((%)	Disagree N(%)	Slightly Disagree N(%)	Slightly Agree N(%)	Agree N(%)	Totally Agree N(%)	Mean±StD
Authentic Experience							
AUT1	28(6.14)	62(13.60)	28(6.14)	79(17.32)	176(38.60)	83(18.20)	4.23±1.49
AUT2	22(4.85)	51(11.23)	17(3.74)	63(13.88)	200(44.05)	101(22.25)	4.48±1.42
AUT3	10(2.18)	20(4.37)	17(3.71)	49(10.70)	238(51.97)	124(27.07)	4.87±1.12
AUT4	15(3.28)	23(5.02)	18(3.93)	38(8.30)	236(51.53)	128(27.95)	4.84±1.21
Overall AUT	6(1.30)	21(4.57)	26(5.65)	97(21.09)	208(45.22)	102(22.17)	4.71±1.09
Feedback							
FEE1	24(5.24)	50(10.92)	19(4.15)	65(14.19)	202(44.10)	98(21.40)	4.45±1.43
FEE2	22(4.81)	49(10.72)	14(3.06)	83(18.16)	201(43.98)	88(19.26)	4.44±1.38
FEE3	24(5.29)	48(10.57)	24(5.29)	68(14.98)	195(42.95)	95(20.93)	4.43±1.43
FEE4	26(5.74)	51(11.26)	26(5.74)	58(12.80)	199(43.93)	93(20.53)	4.40±1.46
Overall FEE	17(3.70)	28(6.09)	43(9.35)	80(17.39)	203(44.13)	89(19.35)	4.50±1.28

Note: ROL-Role modelling, REF-Reflection, DES-Instructional design, COL -Collaboration, AUT- Authentic experience, FEE-Feedback

Next, Figure 2 presents the grouped SQD model training strategies as perceived by student-teachers. The domain was grouped based on the overall mean scores, whereby those with 1 and 2 scores were assigned 'low", those with 3 and 4 mean scores were labelled "medium", and those with 5 and 6 mean scores were termed "high". Based on this categorisation, all SQD model training strategies (role model, reflection, authentic experiences, collaboration, instructional designs and feedback) were observed to have high perceptions of each training strategy, followed by medium perception, and lastly, low perception.

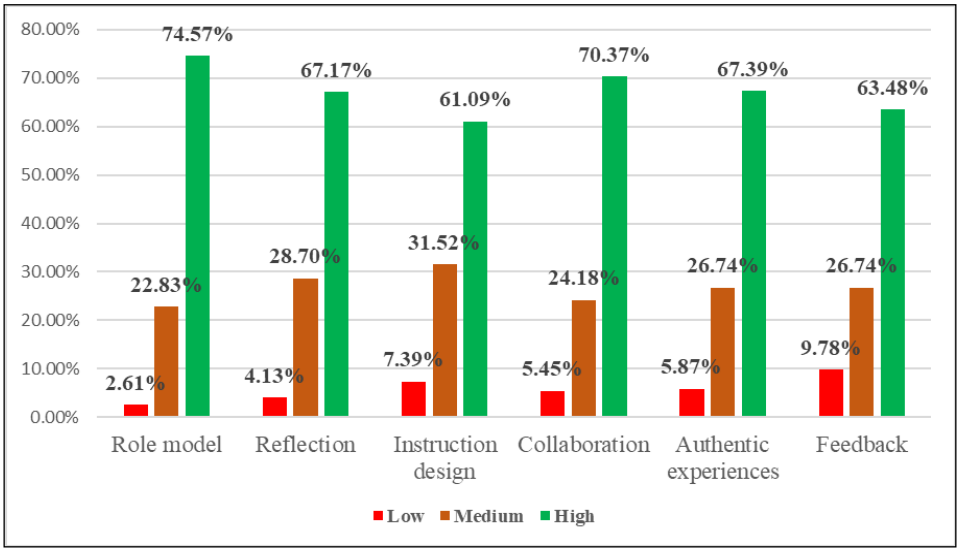

Figure 2: Perceived Support and Training Strategies Based on SQD Training Strategies

Furthermore, the percentile of SQD model training strategies domains was performed and categorised into three groups of perceived strategies incorporated in training student-teachers to use ICT as a pedagogical tool (cf. Figure 3). The first group included those who scored one and two and were labelled as Low perceived strategies with only 2.26 per cent. The second group was the one with a mean score ranging from three to four and were regarded as Medium perceived strategies with 30.09 per cent. The final category comprised the mean score of five and six were labelled as High perceived strategies with 67.75 per cent.

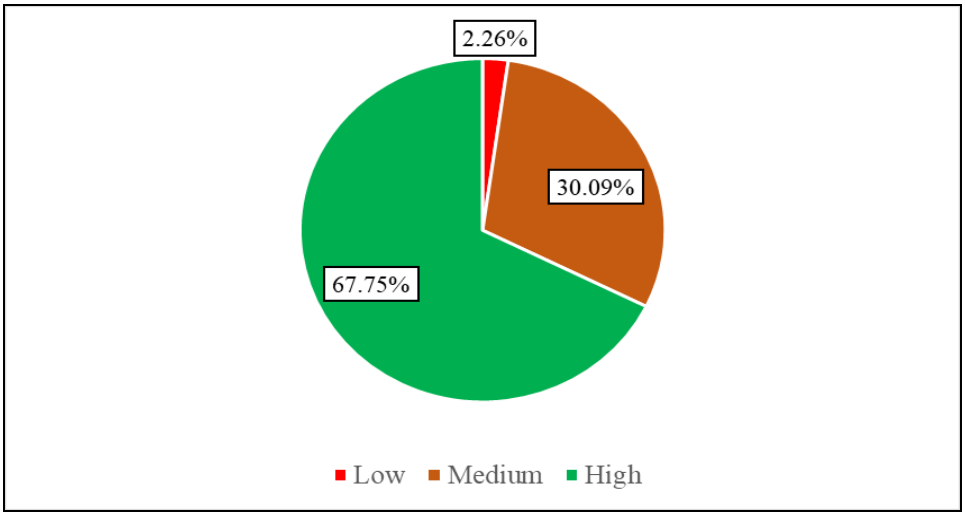

Figure 3: Student-Teachers' Perceived SQD Training Strategies

The Effects of Demographic Characteristics on Perceived Training Strategies

Multiple linear regressions were performed, as is evident in Table 5, to determine the effect of gender, age, and subject specialisation on the student-teachers' perceptions about incorporating SQD model training strategies in their learning to teach with digital technologies.

Table 5: Multiple Linear Regressions for the Demographic Factors and Perceived SQD Model Training Strategies

Dummy Variables	Parameter Estimate	Standard Error	t Value	p-Value	VIF
Intercept	4.03020	0.29480	13.67	<.0001	0
Gender					
Male	0.03134	0.10003	0.31	0.7542	1.05289
Female	Ref				
Age category in years					
16 to 20	Ref				
21 to 25	0.52488	0.27318	1.92	0.0553	8.17756
26 and above	0.65498	0.28060	2.33	0.0200**	8.22701
Area of Specification					
Social science subjects	0.48976	0.13588	3.60	0.0003**	1.04355
Natural sciences	Ref				

Dependent variable: Perceived SQD model training strategies
Note: **Demographic factor is statistically significant $p < 0.05$

From the results, the perceived SQD model training strategy was significantly associated with age 26 and above years (β=0.65498, p=0.0200) compared to the 16 to

20 years old category. It was also observed that being in arts subjects has a statistically significant positive impact on perceived SQD model training strategy (β=0.48976, p=0.0003) compared to science subjects. Finally, it was observed that gender has a statistically insignificant (β= 0.03134. p= 0.7542) effect on the perceived SQD model training strategy.

Discussion

Descriptive data analysis reveals that overall, student teachers generally had positive perceptions of all six SQD model training strangles. Specifically, the teacher-educator as a role model strategy was ranked the highest. The findings are in line with previous studies that demonstrate the importance of teacher-educators as role model in ICT training in teacher education (Faustino, 2024; Lai, 2015; Tondeur et al., 2012; Tondeur et al., 2016). According to Lai (2015), teacher educators play the roles related to affection (i.e., encouragement and enhancing awareness for technology use), capacity (i.e., use recommendations and tips), and behavioural support (i.e., the teacher serves as a model for technology use). However, teacher educators' technology modelling in simplistic styles cannot bring about desired learning outcomes (Admiraal et al., 2017). The consequences of teacher educators being highly regarded as role models could be due to their significant influence as transformative agents in forming learners' knowledge and attitudes towards the integration of ICT in pedagogy (Faustino, 2024; Jadman & Cabigas, 2023; Rukajat et al., 2023).

Alternatively, inadequate ICT pedagogical skills among student teachers could have precipitated them to place much emphasis on the importance of teacher educators as role models (Mtebe et al., 2021; Ngao et al., 2022). Pinto-Santos et al. (2022) argue that student-teachers lack the required professional digital knowledge and skills. On the other hand, the findings are in contrast with those of Hsu and Lin (2020), where role modelling was ranked third out of six SQD model training strategies by student teachers. Interestingly, the lack of basic ICT competencies was not marked as a problem in Hsu and Lins' (2020) study sample. Presumably, ICT basic skills and ICT pedagogical competencies could promote student teachers' confidence, which in turn explains why they might place less emphasis on teacher educators as role models. Moreover, the lack of adequate ICT pedagogical competencies, a common problem among teachers and student teachers in Tanzania (Mtebe et al., 2021; Ndibalema, 2020; Ngao et al., 2020), probably can explain why they highly value teacher educators as role models. Collaboration with peers as a training strategy, the process of student-teachers working together to

develop competencies for the pedagogical use of ICT (Hao & Lee, 2017), was rated second out of six SQD strategies. Aspects such as available occasions to work with peers on the pedagogical use of ICT and perceived support and encouragement from peers were used to capture studentteachers perceptions with reference to collaboration. The findings concur with such previous empirical studies as Hao and Lee (2017), Kafyulilo (2019), and Tondeur et al. (2012). Working together as a team in learning to teach with technology allows student-teachers to share learning experiences. The least rated training strategies were instructional design (M=4.56; SD=1.15) and continuous feedback (M=4.50; SD=1.28).

The findings suggest that student teachers do not feel adequately supported in designing instructional materials incorporating digital technologies. They may have received inadequate continuing feedback, for example, on how they could further develop ICT competence. The lower rating of instructional design and continuous feedback as ICT training strategies may suggest difficulties in implementing them (Dhahri & Khribi, 2021). The findings are in line with previous studies (Mouza et al., 2014; Pinto-Santos et al., 2022; Tondeur et al., 2018), suggesting that instructional design and feedback related to educational technology use might be complex and challenging tasks. Yet other studies (Tondeur et al., 2012; Valtonen et al., 2015; Urbina & Statti, 2022) highly regard feedback as a powerful strategy, especially in promoting the learning progress. In this regard, instructional design and continuous feedback low ratings in the present study may merely mean that they were less value than other strategies. Teacher preparation programmes should promote technology-based instructional design and feedback mechanisms to be functional, supportive, and tailored to their requirements (Nair & Karan, 2024). The gender-based analysis revealed that the effect of gender on perceived SQD model training strategies is statistically insignificant (p-value=0.7542). In other words, the present study concludes that gender does not significantly influence student teachers' perceptions of training strategies for ICT integration in teaching and learning. The findings concur with other previous studies (Arumugam, 2011; Soh, 2020; Tondeur et al., 2016) in the sense that gender did not significantly predict ICT acceptance and usage. However, this is in contrast with other studies (Jiménez-Hernández et al., 2020; Weidlich & Kalz, 2023) that gender difference influences student-teachers with regard to the use of educational technology strategies during the course of teacher education.

Differences in the educational context, cultural differences, and sample size could be the possible reasons for this discrepancy.

For example, differing access to ICT resources and training opportunities between educational institutions over time may also play a role. The age-based analysis of student teachers shows that their perceptions about ICT training strategies were significantly associated with age. More specifically, the effect was apparent to older student teachers (26 years and above) compared to relatively young ones (16 to 20 years old). Although Sánchez-Mena et al. (2017) acknowledge the age gap, as was revealed in the present study, their findings suggest that the perceived ease of using ICT was more positive among younger teachers and less positive among older teachers. Interestingly, both study findings concur with those of Tarhini et al. (2014) and Sánchez-Mena et al. (2017), suggesting an age-based gap in the acceptance of ICT in teaching and learning. The findings suggest a generational gap that can affect not only the teachers' perception of training strategies but also the extent to which they invest time and efforts to learn about educational technology use. Thus, it can be deduced that different student teachers' age groups comprehend and benefit in different ways from the support and strategies for educational technology use. The findings also revealed the role of subject specialisations in understanding student teachers' perceptions of ICT support and training strategies. It was observed that compared to the science subjects' cohort, being in the art subjects' cohort can significantly influence student teachers' perception of the SQD model training strategy (β=0.48976, p=0.0003). The findings contrast with Alieto et al. (2024) that teachers in the science and mathematics cohort tend to have higher levels of ICT acceptance in teaching and learning. The studies on the development of ICT pedagogical competencies, in general, are extensive (Carrillo,2020; Mouza et al., 2014; Tondeur et al., 2012; Valtonen et al., 2015; Urbina & Statti, 2022). However, the differences and impact of subject specialisations on student teachers' perceptions of training and support are less explored. One reason to explain that gap is that ICT pedagogical skills are universally applicable across academic disciplines. Therefore, teacher training and support tend to focus on these general competencies, assuming that once teachers are proficient with ICT, they can adapt these skills to their specific academic disciplines' needs.

Conclusion and Recommendations

The findings of the present study make a substantial contribution to the field of teacher education by providing insights that can promote ICT

integration in teacher training and support, ultimately fostering inspiring teachers' ICT competencies. The study has identified that role modelling and collaboration with peers are the most effective training strategies for ICT training in teachers' education. Such findings have several implications for teacher education curriculum design, instructional strategies, learning environment and teachers' professional development. Regarding curriculum design, teacher training should consider providing student teachers with more opportunities to observe and engage with their mentors, who are experts in the pedagogical use of ICT. Above all, teacher educators need to model the effective use of technologies in their pedagogical practices. In addition, the teacher training learning environment should be conducive enough to promote collaboration among student teachers. Continuous feedback was the lowest-rated perceived ICT training strategy, though it is recognised as an important strategy in promoting learning progress (Tondeur et al., 2012) and identification of areas for improvement (Tondeur et al., 2016). In addition to training digitally competent teachers, integrating feedback in the teaching and learning process in constructive and actionable ways is considered important (Valtonen et al., 2015).

However, based on the present study's findings, this strategy seems to be under-utilized. Thus, continuous feedback could be taken as a critical area for improvement in teacher training. In this context, the study recommends that in order to comply with the recurring technological development, teacher educators should adopt technological tools and platforms designed to enhance feedback exchanges between teachers and students. These tools include but are not limited to online platforms, digital feedback forms, and student-teacher peer review systems. The present study employed surveya cross-sectional survey, and the data were gathered from a single university and a single college. It is, therefore, recommended that another study consider a larger sample from multiple institutions of teacher education. Finally, the other study may consider employing longitudinal and triangular methods to get further insights into the implementation of effective strategies for training and supporting student-teachers to use technology as a pedagogical tool.

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