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Article

Evaluation of Pre-service Teachers' Digital Competence in Limpopo Province, South Africa

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Abstract: Digital technology can potentially improve the quality of education in rural communities by creating conducive conditions for collaboration among learners, providing interactive learning tools and offering opportunities for personalised learning experiences. The pre-service teachers are a critical human resource in improving the quality of education. Therefore, this study investigated the perceptions of pre-service teachers' technical, pedagogical, attitudinal and ethical digital competence and their readiness to use digital technologies to enhance their teaching practices in Limpopo Province in South Africa. The theoretical framework that guided the study was the Pedagogical, Ethical, Attitudinal and Technical model (PEAT). This descriptive study used a quantitative approach by employing a cross-sectional survey design. A conveniently selected sample of 123 pre-service teachers participated in the study. The research instrument used to collect data was a Questionnaire of Pre-service Teachers' Digital Competence. The quantitative data collected were analysed using descriptive statistics. The study's findings were that preservice teachers had positive attitudes towards digital technologies, perceived themselves as having high technical digital competence and perceived ICT use in school as contributing positively to learning. They had lower perceptions regarding their competences in using specific digital technologies in teaching and their knowledge of ethical issues. They had the lowest perceptions in the university's role in preparing them for integrating digital technologies into teaching. These findings underscore the necessity of teacher educators to explore new strategies to enhance student teachers' digital competences.

Keywords: Digital technology; digital competence; PEAT model; pre-service teachers; technology integration in teaching

Introduction

In the past few decades, digital technology has advanced rapidly, bringing extensive transformations in education worldwide. Technology integration in teaching is necessitated by the need to improve the quality of teaching and learning (Singh, 2021). There is an urgent call for teachers to use technology creatively to enhance the learning experiences that foster knowledge creation, technological literacy and innovative thinking in today's learners (United Nations Educational Scientific and Cultural Organization, 2011). Integrating digital technology in teaching can contribute to attaining 21st-century skills such as critical thinking and problem-solving, communication and collaboration, and creativity and innovation (Trilling & Fadel, 2009).

Many countries have made inroads in developing policies to enhance the integration of digital technology in education. In South Africa, the Professional Development Framework for Digital Learning (Department of Basic Education, 2019) articulates the aspirations and vision of South Africa in the digital era.

According to this document, digital literacy is the appreciation of the potential of digital tools and resources to enable oneself to live productively in the digital society. The cornerstone of the 2019 framework is digital learning, defined as any learning or teaching activity that utilises digital tools and resources effectively to enrich a learner's understanding. The focus in using these digital tools and resources should be the achievement of curriculum learning objectives.

While it is observed that access to digital tools and resources may be constrained in rural communities due to inadequate, inappropriate, and outdated technological resources (Venketsamy & Zijing, 2022), their availability alone would not guarantee that the vision of the integration of digital technology can be realised. Many empirical studies show that the lack of knowledge and skills by teachers on how to integrate ICT in the teaching-learning process is a significant barrier to the utilisation of the resources that are currently available in rural communities (Nandipha et al., 2023; Venketsamy & Zijing, 2022). This leads to the widening gap in digital technology utilisation between urban and rural populations, resulting in an urban-rural digital divide.

The digital divide is no longer only limited to access to devices or the skills to operate the devices but now extends to whether one has the knowledge, attitudes, and strategies that can be utilised in using the technologies creatively and critically to benefit oneself and the community (Ferrari, 2012). The implications of this are that the availability of digital tools and resources alone without digital competence cannot guarantee their effective utilisation. Therefore, teachers in rural communities must be digitally competent to contribute towards educational transformation to narrow the urban-rural digital divide.

There is a paucity of empirical studies that have explored the perceptions of pre-service teachers in rural communities on their digital competence and how their initial teacher education programs prepare them for integrating technology into the teaching and learning process (Gudmundsdottir & Hatlevik, 2018). The limited research on pre-service teachers' digital competence in rural communities creates a knowledge gap, impeding the effective integration of digital technology in teaching and constraining the design of targeted intervention in initial teacher preparation. Therefore, this study investigated the digital competence of pre-service teachers and the role played by the university in preparing them to integrate digital technology into teaching. The study aims to answer the following research questions: How do pre-service teachers perceive their technical, pedagogical, ethical and attitudinal digital competence? How do pre-service teachers perceive the role of initial teacher education in preparing them for integrating technology into the teaching-learning process?

Literature Review

The use of digital technologies in education has accelerated in recent years. These technologies include laptops, desktops, digital projectors, iPods, tablets, smartphones, smartboards, and digital screens among others. Software that works with these devices are educational applications like Moodle; web 2.0 technologies such as wikis, podcasts, and blogs; content creation tools from Google such as Blogger, Forms, and Docs; and multimedia such as simulations, games, digital virtual laboratories and virtual reality; and artificial intelligence (Singh, 2021). Digitally competent teachers would have the knowledge, skills and attitudes to integrate these technologies into instruction effectively. These technologies continue to evolve at a rapid pace.

Digital technology impacts the quality of education as it improves the pedagogical approaches available to teachers. Examples include application programs that provide learners with immediate feedback, adaptive learning, access to experts worldwide, learning games, and simulation activities, which create a conducive and engaging classroom atmosphere (Kiru & Abuya, 2023). Furthermore, learning management systems allow automation of daily activities such as taking attendance and grading learners' work and provide online and offline avenues for collaboration with colleagues (Kiru & Abuya, 2023). Therefore, teachers in rural communities must utilise these technologies to improve education quality.

Teachers' low levels of digital competences are a significant obstacle to realising digital technology integration in teaching (Howie et al., 2005). Integrating digital technology in instruction helps learners gain skills useful in their future careers, such as knowledge creation, communication, and teamwork skills, and helps them become lifelong learners (Howie et al., 2005). It is, therefore, important that universities put

measures in place to increase the digital competence of pre-service teachers to improve the quality of education in schools.

The increased use of digital technologies in education in the last few decades necessitated empirical studies examining teachers' digital competences at various levels of education. It is assumed that the current generation of university students are digital natives, but empirical research shows that there is a need to question this assumption. For example, a review of the literature on the digital competence of university students by Sánchez-Caballé et al. (2020) revealed that university students do not have an elevated level of digital competence. Hence, there is a need to nurture university students' digital knowledge, skills, and attitudes.

Numerous studies have examined the digital competence of university students. Duncan-Howell (2012) investigated the digital competence of undergraduate students enrolled in pre-service education degrees at an Australian university. They concluded that while the students had strong digital competence, they used their competence to consume information rather than create content. López-Meneses et al. (2020) similarly investigated the digital competence of university students. Their findings were that the students had better competence in information and digital literacy, communication, and collaboration but less competence in digital content creation. Engen et al. (2014) investigated the levels of digital competence of students entering teacher education studies in Norway. Their results were that the students spent less time on advanced programs and activities. Similarly, Nandipha et al. (2023) investigated pre-service science teachers' views and experiences on using technology in teaching. The study's results indicate the need for teachers to have technology integration strategies to accommodate learners with different learning abilities.

Digital competence is the knowledge, skills and attitudes required for the effective use of digital technologies and communication tools to achieve specific goals at work, education and in daily life (Ferrari, 2012). The Pedagogical, Ethical, Attitudinal and Technical model (PEAT model) conceptual framework encompasses the components of digital competence in the definition provided by Ferrari (2012) but refers specifically to teachers' digital competence. The PEAT model is shown in Figure 1.

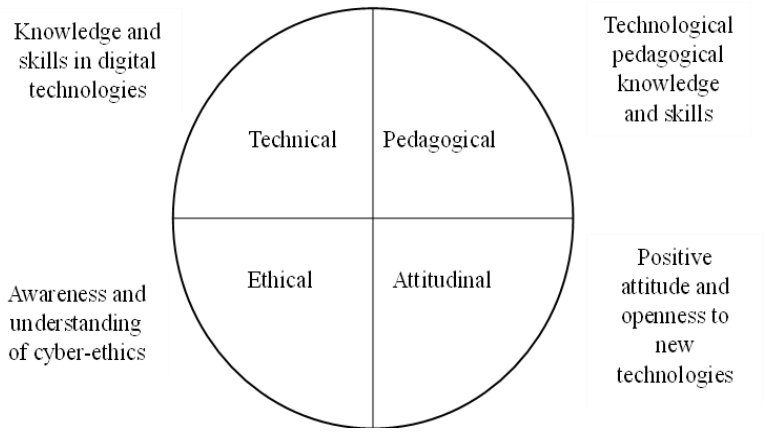

Figure 1 The PEAT model of teachers' digital competence
Source: McGarr & McDonagh (2019)

The technical digital knowledge involves the teacher's skills and knowledge of digital technologies, including content creation, word processing, and presentation tools (McDonagh et al., 2021). The ethical digital knowledge encompasses understanding the risks of the internet and online communication, the validity and reliability of online information, and the legal and ethical principles behind collaborative tools (McGarr & McDonagh, 2019).

The pedagogical digital knowledge encompasses the teacher's understanding and skills in using various digital technologies in teaching and learning (McDonagh et al., 2021). It consists of the knowledge of using various tools and software for pedagogical purposes, such as learning management systems, educational games, and tools for content creation. The attitudinal digital knowledge encompasses the teacher's attitudes to

digital technologies and openness to exploring new and emerging technologies (McDonagh et al., 2021). The attitudes expected from teachers as professionals include being critical and reflective towards information, being responsible users, and being interested in engaging in online communities and networks (Ferrari, 2012).

Methodology

1. Research Design

The study used a survey design. The cross-sectional survey was designed to produce a 'snapshot' of a population at a particular time (Cohen et al., 2002). This design is suitable for describing and interpreting educational issues and explaining the nature of existing conditions to contribute to understanding the prevailing situation (Cohen et al., 2002). We aimed to describe and interpret the existing conditions regarding the digital competences of pre-service teachers.

2. Sample

The population was all the preservice teachers at the rural university where the study was conducted. The participants were selected by non-probability convenience sampling. The sample had 123 preservice teachers. Permission to conduct the study was obtained from the university for compliance with ethics principles (Ethical Clearance No. FHSSE/23/PCEM/03/3008). Informed consent was sought from the participants, and they were informed of their right to withdraw from the study at any moment.

3. Data Collection

The research instrument used for data collection is the Questionnaire on Pre-service Teachers' Digital Competence. This instrument was adapted from the DiCTE questionnaire (DiCTE, 2019) on digital competence, with four extra questions from Alnasib (2023) dealing with pre-service teachers' perceptions of their initial teacher preparation for integrating technology. The questionnaire had 47 items, 43 of which were from the DiCTE questionnaire, with few modifications meant to determine the digital competence of pre-service teachers. The validity and the reliability of the DiCTE questionnaire are reported in the literature, and it has already been used in different countries with different samples, enhancing its validity and reliability for its subsequent application (Giæver et al., 2020; Gudmundsdottir et al., 2021). To determine the content validity, two experts in education were asked to study the questionnaire. They suggested a few changes to the wording of the instrument to bring clarity, and their input was used to improve the instrument. The reliability was determined through Cronbach's Alpha to check the instrument's internal consistency. Cronbach's alpha was 0.887, implying the instrument had high internal consistency and reliability (Aithal & Aithal, 2020).

The questionnaire consisted of 5-point Likert-type items with responses ranging from very poor/strongly disagree (1), poor/disagree (2), undecided (3), good/agree (4), and very good/strongly agree (5). Fourteen items were on the attitude dimension, nine were on the technological dimension, five were on the ethical dimension, fifteen were on the pedagogical dimension, and four were on the university's role in preparing preservice teachers for integrating digital technologies in teaching. The questionnaire was administered online using Google Forms. The link to the Google Forms was sent online to 200 respondents in the final year of their teaching degree, and 123 responded.

4. Data Analysis

The data on Google Forms was imported to IBM SPSS Statistics Version 28, used for analysis. All negatively worded statements were reverse coded before determining the descriptive statistics from the raw data.

The Findings

Of the 123 preservice teachers who participated in the study, the percentage of males was 46.8% and females 53.2%. Thirty-eight per cent of the students were over 30 years old, 48.4% were between the ages of 26 and 30 and 13,6% were between the ages of 21 and 25. Table 1 shows the descriptive statistics regarding the main dimensions of the preservice teachers' digital competence. The perceived competence with a mean of 3.58 is

average; below this value, the perceived competence is regarded as low and above this value, it is high. The results indicate that the preservice teachers had positive attitudes towards digital technology as the majority of them agreed or strongly agreed with positive statements such as the *use of computers support my understanding of a topic* and disagreed with negative statements on attitudes. In the pedagogic dimension on the teachers beliefs on the use of ICT in teaching at school the majority of preserve teachers believed that ICT has a positive influence on learning and they perceived themselves to have high technical digital skills. The perceived competence was low in the pedagogy dimension regarding using various specific tools and applications for teaching. They had low perceived competence in the ethical dimension of digital competence. The university's role in preparing the preservice teachers for using digital technologies in the teaching practice received the lowest rating.

Table 1. Descriptive statistics of the main dimensions

Dimension	**N**	**M**	**SD**
Attitudinal dimension	123	4.37	0.70
Pedagogical dimension (ICT Use in School)	123	4.10	0.88
Technical dimension	123	3.99	0.66
Ethical dimension	123	3.33	0.84
Pedagogical dimension (Use of specific tools for teaching)	123	3.03	1.05
Teacher Education	123	2.77	0.40

N = Sample size, M = Mean, SD = Standard Deviation

1. Technical Digital Competence

The technical competence of the pre-service teachers was explored by asking them to rate themselves in their ability to use word processors, spreadsheets, presentation tools, image processing tools, video editing tools, digital collaborative writing tools, systems for cloud storing of files, social media, and email. Since most preservice teachers (more than 80%) rated themselves as good or very good in using word processors, spreadsheets, presentation tools, social media, and email (Table 2), their perceived digital competence in these skills were high. Their perceptions were lower in image processing skills (70.7% good or very good) and video editing (65.3% good or very good). The lowest ratings were recorded for using digital collaborative writing tools and systems for cloud-storing files (less than 47.8% good or very good). Using the criteria suggested by Pimentel and Pimentel (2019), which suggest that weighted means from 1.00 to 1.79 signifies very poor/strongly disagree, 1.80 to 2.59 poor/disagree, 2.60 to 3.39 undecided, 3.40 to 4.19 good/agree and 4.20 to 5.00 very good/strongly agree, the preservice teachers perceived themselves to be good in spreadsheets, presentation tools, image processing tools, video editing tools, digital collaborative writing tools, systems for cloud storing of files and very good in social media, email, and word processors (Table 2). The preservice teachers' overall perception is that they had good technical skills.

Table 2. Preservice teachers perceived Technical Digital Competence

Rate your competence when it comes to using:	**Very poor *f*(%)**	**Poor *f*(%)**	**Undecided *f*(%)**	**Good *f*(%)**	**Very good *f*(%)**	**M**	**SD**
Word processor	0(0)	3(2.4)	9(7.3)	64(52.0)	47(38.2)	4.26	0.70
Spreadsheet (e.g., Excel)	1(0.8)	5(4.1)	17(13.8)	64(52.2)	36(29.3)	4.05	0.82
Presentation tools (e.g., PowerPoint)	0(0.0)	6(4.9)	20(16.3)	54(43.9)	43(35.0)	4.09	0.84

Image processing	1(0.8)	5(4.1)	30(24.4)	46(37.4)	41(33.3)	3.98	0.91
Video editing	3(2.4)	11(8.9)	28(22.8)	39(31.7)	42(34.1)	3.86	1.07
Digital collaborative writing tools	4(3.3)	24(19.5)	37(30.1)	36(29.9)	22(17.9)	3.39	1.09
Systems for cloud storing of files	5(4.1)	17(14.8)	40(32.5)	36(29.3)	25(20.3)	3.48	1.09
Social media	0(0.0)	5(4.1)	18(14.6)	34(27.6)	66(53.7)	4.31	0.87
Email	0(0.0)	3(2.4)	11(8.9)	32(26.0)	77(62.6)	4.49	0.76

2. Pedagogical Digital Competence: Pedagogical Competence Regarding Tools Used in The Teaching-Learning Process

Table 3 shows the perceived competencies of the preservice teachers in using various tools in the teaching-learning process. The perceived competencies are relatively low in all the various tools preservice teachers were required to rate themselves. The lowest perceived competencies were reported in using tools for interactive whiteboards and tools for graphical representation (31.7% good or very good for each). The same pattern of low perceptions was observed for the use of educational games (47.1% good or very good), learning management systems (42.3% good or very good) and students' response systems (43.9% good or very good). This may imply that pre-service teachers did not have sufficient practice in using these pedagogic tools at university. Applying Pimentel and Pimentel's (2019) criteria, we conclude that the preservice teachers were undecided about their competence in using all the tools, as the weighted mean ranges from 2.80 to 3.15.

Table 3. Frequencies of perceived competencies of the students in the use of specific tools in the teaching-learning process

Rate your competence when it comes to:	**Very poor *f*(%)**	**Poor *f*(%)**	**Undecided *f*(%)**	**Good *f*(%)**	**Very good *f*(%)**	**M**	**SD**
Learning management systems (e.g., Moodle)	8(6.5)	46(37.4)	17(13.8)	38(30.9)	14(11.4)	3.03	1.18
Tools for creating content	10(8.1)	25(20.3)	44(35.8)	31(25.2)	13(10.3)	3.10	1.10
Tools for interactive whiteboards	11(8.9)	28(22.8)	45(36.6)	25(20.3)	14(11.4)	3.02	1.12
Tools for creating graphical representations	19(15.4)	38(31.9)	27(22.0)	26(21.1)	13(10.6)	2.80	1.24
Educational games	14(11.4)	30(24.4)	21(17.1)	39(31.7)	19(15.4)	3.15	1,27
Student response systems (e.g. Kahoot, Socrative…)	19(15.4)	25(20.3)	25(20.7)	39(31.7)	15(12.2)	3.05	1.28

3. Pedagogic Digital Competence: Perceptions regarding ICT Use in School

Preservice teachers' perceptions regarding ICT use in school were positive. Their perceptions of the use of ICT in schools were explored by asking questions regarding classroom management, academic achievement, motivation, collaboration among learners and search for information (Table 4). The preservice teachers agreed or strongly agreed that the use of ICT in school supports pupils' independent learning (79.7%), enhances pupils' academic achievement (86.2%), contributes to pupils' motivation for learning (81.3%), facilitates collaboration among pupils (79.7%), and helps pupils find information effectively (85.4%). Most preservice teachers disagreed or strongly disagreed (74.7%) that using ICT in school reduces pupils' focus on schoolwork. Similarly, a large percentage disagreed or strongly disagreed that using ICT in school disrupts classroom activity (66.7%) and challenges classroom management (70%). The preservice teachers disagreed that using ICT reduces pupils' focus on schoolwork, disrupts classroom activity and challenges classroom management. The preservice teachers strongly agreed that using ICT in school supports pupils' independent

learning, enhances pupils' academic achievement, contributes to pupils' motivation for learning, facilitates collaboration among pupils, and helps pupils find information effectively.

Table 4. Perceptions of pre-service teachers on using of ICT in teaching

Do you agree with the following statements about the use of ICT in teaching at school:	**Strongly disagree *f*(%)**	**Disagree *f*(%)**	**Undecided**	**Agree *f*(%)**	**Strongly agree**	**M**	**SD**
Reduces pupils' focus on schoolwork.	73(59.3)	19(15.4)	16(13.0)	11(8.9)	4(3.3)	1.81	1.16
Disrupts classroom cohesion	45 (36.6)	37(30.1)	27(22.0)	10(8.1)	4(3.3)	2.11	1.10
Challenges classroom management	51 (41.5)	35 (28.5)	19 (15.4)	12 (9.8)	6 (4.9)	2.08	1.19
Supports pupils' independent learning	6(4.9)	9(7.3)	10(8.1)	35(28.5)	63(51.2)	4.14	1.15
Enhances pupils' academic achievement	5 (4.1)	8 (6.5)	4 (3.3)	31 (25.2)	75 (61.0)	4.33	1.08
Contributes to pupils' motivation for learning	5 (4.1)	8 (6.5)	10 (8.1)	21 (17.1)	79 (64.2)	4.31	1.12
Encourages pupils' copying from the Internet	31 (25.2)	40 (32.5)	30 (24.4)	13 (10.6)	9 (7.3)	2.42	1.19
Facilitates collaboration among pupils	5 (4.1)	7 (5.7)	13 (10.6)	30 (24.4)	68 (55.3)	4.21	1.10
Helps pupils to find information effectively	5(4.1)	6(4.9)	7(5.7)	21(17.1)	84(68.3)	4.41	1.07

4. Perceptions Regarding Competence in Cyber-Ethics

The knowledge of the preserve teachers regarding cyber ethical issues was examined through questions on applying copyright and private rules online, the ability to detect cyberbullying and evaluation of the credibility of digital information. The study revealed severe deficiencies in the preservice teachers' competencies regarding copyright rules (34.5% good or very good) and privacy (32.5% good or very good) in online activities. Only half indicated that they were good or very good at detecting cyberbullying. The perceived digital competence in ethical issues was better in acting if an unwanted image was posted online (61% good or very good) and in evaluating the credibility of digital information (63.4% good or very good). Applying the criteria of Pimentel and Pimentel (2019), the preservice teachers were undecided in their ability to apply copyright rules and private rule online. They perceived themselves as good at acting if someone posts an unwanted image of them on the internet and evaluating the credibility of digital information.

Table 5. Perceived competencies in cyber ethics issues

Rate your competence when it comes to:	**Very poor *f*(%)**	**Poor *f*(%)**	**Undecided *f*(%)**	**Good *f*(%)**	**Very good *f*(%)**	**M**	**SD**
Applying copyright rules online	12(9.8)	33(26.8)	35(28.5)	37(30.1)	6(4.1)	2.93	1.08
Applying private rules online	12(9.8)	24(19.5)	47(38.2)	33(26.8)	7(5.7)	2.99	1.04
Detecting cyber bullying	7(5.7)	13(10.6)	37(30.1)	53(43.1)	13(10.6)	3.42	1.01
Taking action if someone posts an unwanted image of me on the internet	4(3.3)	15(12.2)	29(23.6)	51(41.5)	24(19.5)	3.62	1.04
Evaluating the credibility of digital information	3(2.4)	16(13.0)	26(21.1)	49(39.8)	29(23.6)	3.69	1.05

5. Attitudes of Preservice Teachers towards Digital Technology

Most preservice teachers (more than 80% agree or strongly agree) believe that using computers, tablets, or mobile devices supports their understanding of a topic, is helpful when learning, makes them want to learn, and makes learning easier. Also, most preservice teachers (more than 75% disagree or strongly disagree) reported that the use of computers, tablets or mobile devices does not cause pain in arms and shoulders, headache, sore eyes, lead them off studies, make them prolong schoolwork, steal the time they could use to understand a topic and disturb them when learning subjects. These results imply that the preservice teachers have a positive attitude towards using ICT (Table 6). The preservice teachers' attitudes towards ICT were further explored by asking them whether a teacher should have a positive attitude towards ICT, whether a teacher should use ICT to vary their teaching method, and whether a teacher should use ICT in their teaching practice. Table 6 shows the frequencies of the participant's responses in the three categories. Many of the preservice teachers (85% and above) agree or strongly agree that a teacher should have a positive attitude towards ICT and that the teacher should use ICT to vary the teaching methods and should use ICT in teaching practice. This further confirms their belief in the central role that ICT can play in the teaching-learning process.

Table 6. Attitudes of preservice teachers towards ICT

The use of computers, tablets and smartphones during studies:	**Strongly disagree f(%)**	**Disagree f(%)**	**Undecided f(%)**	**Agree f(%)**	**Strongly agree f(%)**	**M**	**SD**
Support my understanding of a topic	2(1.6)	3(2.4)	8(6.5)	26(21.1)	84(68.3)	4.52	0.85
It is helpful when learning subjects	2(1.6)	5(4.1)	6(4.9)	26(21.9)	84(68.3)	4.50	0.89
Makes me want to learn	1(0.8)	3(2.4)	12(9.8)	26(21.1)	81(65.9)	4.49	0.83
This leads to pain in the arms and shoulders	64(52.0)	44(35.8)	7(5.7)	5(4.1)	3(2.4)	1.69	0.93
Leads to headache	82(66.7)	24(19.5)	10(8.1)	4(3.3)	3(2.4)	1.55	0.95
Gives me sore eyes	80(65.0)	25(20.3)	5(4.1)	8(6.5)	5(4.1)	4.41	1.04
Leads me off study activities	76(61.8)	22(17.9)	16(13.0)	7(5.7)	2(1.6)	1.67	1.01
It makes me prolong schoolwork	63(51.2)	30(24.4)	18(14.6)	9(7.3)	3(2.4)	1.85	1.08
Makes it easier for me to learn	4(3.3)	6(4.9)	6(4.9)	25(20.3)	82(66.7)	4.42	1.02
Steal time I could use to understand a topic	50(40.7)	49(39.8)	14(11.4)	8(6.5)	2(1.6)	1.89	0.96
Disturbs me when learning subjects	59(48.0)	37(30.1)	17(13.8)	7(5.7)	3(2.4)	1.85	1.03
A teacher should have a positive attitude towards ICT	2(1.6)	3(2.4)	11(8.9)	20(16.3)	87(70.7)	4.52	.88
A teacher should use ICT in their teaching	0(0.0)	5(4.9)	8(6.5)	38(30.9)	72(58.5)	4.44	0.79
A teacher should use ICT to vary their teaching method	0(0.00)	4(4.1)	11(8.9)	31(25.2)	76(61.8)	4.45	0.82

6. Perceptions on The Role of The University In Preparing Preservice Teachers for The Integration of Digital Technology

Table 8 shows preservice teachers' perceptions of the university's role in preparing them for digital technology. The table shows that many preservice teachers were not satisfied that the university had sufficiently prepared them to use digital technologies in their careers. Only 58.2 % of the preservice teachers agreed or strongly agreed that the university had provided them with a strong base for integrating technology into their teaching.

About a quarter of the preservice teachers felt that the university had not provided a solid foundation for integrating technology into their teaching. A considerable proportion of the preservice teachers (87.8% agree or strongly agree) believed there was a need to change their degree courses to integrate educational technology. A similarly substantial proportion (85.4% agree or strongly agree) felt that there is a need to incorporate technology into the educational courses in their degree programmes. However, 77.8% of them agreed that the academic courses in their degree programs contained subjects related to the use of technology in teaching. Their dissatisfaction with how the technology is integrated into their degree programs may explain why they felt there was a need for changes in those courses.

Table 7. Perceptions on the role of the university in teacher preparation for integration of technology

Respond to the following statements:	**Strongly disagree f(%)**	**Disagree f(%)**	**Undecided f(%)**	**Agree f(%)**	**Strongly agree f(%)**	**M**	**SD**
The teacher education programme at my university has provided me with a solid foundation for integrating technology into my teaching	7(5.7)	25(20.3)	20(16.3)	50(40.7)	21(17.5)	3.43	0.93
There is a need to change teacher preparation programmes in the degree so that educational technology is integrated into teaching and learning.	1(0.8)	5(4.1)	9(7.3)	65(52.8)	43(35.0)	1.83	0.80
There is a need to integrate technology into the educational courses in the programme (e.g., unique teaching methods, lesson design)	3(2.4)	4(3.3)	11(8.9)	52(42.3)	53(43.1)	1.80	0.91
The educational courses in the programme, such as lesson design, unique teaching methods, and others, deal with subjects related to the use of technology in teaching	2(1.6)	5(4.1)	24(19.5)	49(39.8)	43(35.0)	4.02	0.93

Discussion

Many preservice teachers reported high competencies in word processors, spreadsheets, presentation tools, social media, and emails. Engen et al. (2014) also found related results. However, they cautioned that with such high ratings in self-report scales, there is a tendency for students to overrate their skills with applications that they often use, such as word processors. Tomczyk (2021) found comparable results where respondents declare high or remarkably high skills in using software for creating multimedia presentations, operating text editors, and handling spreadsheets. However, Alnasib (2023) reported that pre-service teachers perceive themselves as slightly less skilled in creating digital content than other digital skills. Similar findings were made in this study; only 35.5% of the respondents rated themselves as good or very good in using digital tools for content creation.

We investigated preservice teachers' attitudes towards digital technology in the learning environment, as attitudes are thought to determine acceptance and integration of technology in teaching (Scherer et al., 2018). Our finding was that preservice teachers had positive attitudes towards digital technology, similar to

previous studies (Birkollu et al., 2017; Huda et al., 2018). The positive attitudes of preservice teachers are likely to influence their decisions in selecting teaching methods that integrate technology.

On the ethical dimension, the results of applying privacy rules online and detecting cyberbullying online show that only a few student teachers rated themselves as good, supporting the findings of Porln and Snchez (2016) that fewer preservice teachers understand privacy issues online and how to avoid cyberbullying. Our study confirms that most of the student teachers perceive their ability to evaluate the credibility of information as good. As teachers need high competence in ethical issues online, there is a need for initial teacher preparation courses to consider incorporating topics such as online privacy rules and how preservice teachers can protect themselves. The preservice teachers require these competences to improve the ethical competencies of the learners.

Pre-service teachers' perception that their degree program was only average in preparing them for integrating digital technology into their teaching is in line with the findings of other researchers (Alnasib, 2023). Alnasib (2023) also found, in line with this study, that students felt a need to integrate technology into education courses and reform pre-service teaching programmes. The finding is further supported by Chigona (2015), who observes that the inferior quality of instruction students receive during their initial teacher preparation contributes to new teachers' failure to teach using ICTs. Jita (2016) also reported similar findings that initial teacher education does not prepare preservice science teachers to use technology effectively in instruction.

As the presentation of digital technology courses to student teachers impacts their abilities to integrate technology into teaching (Alnasib, 2023), university curriculum planners must review the courses they offer to enrich them and address their shortcomings. They should create opportunities for the students to have meaningful practice integrating digital technologies in instruction, particularly during their teaching practice. Modelling the integration of digital technologies during instruction by teacher educators while teaching also has the potential to assist the student teachers realise the value of technology in promoting quality education.

Conclusion

One of the findings of this study is that the initial teacher education programs are perceived as not having adequately prepared preservice teachers with the technological competence to execute their teaching by integrating digital technologies. Therefore, we recommend that university curriculum planners develop their ICT courses to make them more comprehensive to assist preservice teachers in creating rich learning environments through effective integration of digital technology in teaching. The study revealed that preservice teachers have positive attitudes towards ICT and believe that integrating ICT in school enhances learning. These findings imply that the preservice teachers realise the potential of ICT in improving the quality of teaching. Their perceived competencies in using some educational applications were found to be low, suggesting that they do not feel ready to integrate technology competently as they embark on their careers.

The study had some inherent limitations which constrain the generalisability of the results. The notable limitations are that the study was conducted at one rural university, so these findings may not apply to other universities, and the study did not focus on actual competence but perceived competence using self-report scales so that the actual competence may differ from the perceived competence. We recommend that similar studies be conducted at urban universities. We also recommend that mixed methods be used to determine the actual competencies of preservice teachers.

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