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EXPLORING THE EFFECTIVENESS OF ICT TOOLS FOR ONLINE TEACHING, LEARNING AND ASSESSMENT AMONG PRE-SERVICE TEACHERS FROM A GHANAIAN UNIVERSITY

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ABSTRACT

As a result of the COVID-19 pandemic, universities in Ghana have embraced the use of Information and Communication Technology (ICT) tools for online teaching, learning, and assessment. However, despite the increasing integration of these tools in education, there is a need to explore their effectiveness in enhancing students learning and educational outcomes. The purpose of this study was thus to explores the effectiveness of integrating ICT tools for online teaching, learning, and assessment in one of the Universities in Ghana. To achieve the purpose of this study, the quantitative descriptive survey design was adopted where a convenient sample of 301 pre-service teachers were selected through and surveyed. The data collected were analyzed using SPSS version 25 and the results showed that majority of pre-service teachers perceived ICT tools as positive for online teaching, learning and assessment. However, challenges like technical skills, unreliable internet, limited access, training needs, academic integrity, support, and student engagement were highlighted as detrimental to online teaching, learning and assessment. The results further revealed interesting age differences in pre-service teachers' viewpoints about effectiveness of ICT tools with older students perceiving ICT tools as more effective for online teaching and learning but less so for online assessment. It was thus recommended that there should be increased educator support and training on ICT integration in teaching and learning, promoting online student collaboration, soliciting ongoing student feedback, and targeted training on effective use of technology for learning for mature learners.

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Background.

The rapid advancement of technology has significantly impacted the field of education, leading to the integration of Information and Communication Technology (ICT) tools in teaching, learning, and assessment practices. Information and Communication Technology (ICT) encompasses a wide range of digital tools that have become integral to education. These tools include computers, internet resources, software applications, and online platforms (Bauer & Kenton, 2018). The integration of ICT tools in online education has revolutionized the teaching and learning process, offering numerous advantages for both educators and learners.

One of the key advantages of ICT tools in education is increased accessibility. Balanskat et al. (2013) argue that these tools break down barriers of time and location, allowing learners to access

educational content and resources anytime and anywhere. Another advantage of ICT tools is that it enhances interactivity in the learning process, and this promotes deeper understanding, critical thinking, and problem-solving skills (Bauer & Kenton, 2018). Similarly, ICT tools deployed on online platforms facilitate real-time communication and collaboration among students and educators, enabling discussion forums, virtual group projects, and peer feedback (Balanskat et al., 2013). Further personalized learning experiences are also facilitated through the integration of ICT tools (Bauer & Kenton, 2018).

The widespread adoption of online education platforms and virtual classrooms has created a need to examine the effectiveness of ICT tools in facilitating remote instruction. There is a growing interest in understanding how these tools can enhance online teaching, learning, and assessment practices. Universities in Ghana, like many other educational institutions, have embraced the use of ICT tools for online teaching, learning, and assessment. However, despite the increasing integration of these tools, there is a need to explore their effectiveness in enhancing educational outcomes and addressing the specific challenges faced by the universities in the online learning environment. Also, few of the studies that have examined the effectiveness of integration of ICT into online teaching and learning, focused mainly on in-service teachers (Ghavifekr & Rosdy, 2015; Ghavifekr et al., 2016). Therefore, this study aims to explore the effectiveness of ICT tools on online teaching, learning, and assessment, examining their benefits, challenges, and overall effectiveness from the perspectives of pre-service teachers. Specifically, to analyze the effectiveness of ICT tools for online teaching, learning, and assessment in one of the teacher education universities in Ghana focusing on instructional delivery, collaboration and communication, access to learning resources, and adaptive and personalized learning.

Objectives of the study.

The objectives of this study were:

- To examine pre-service teachers' perceptions about the effectiveness of ICT tools during online learning, teaching, and assessments.
- To examine differences between measured demographic characteristics and their perceptions about the effectiveness of ICT tools during online learning, teaching, and assessment.
- To identify challenges of integrating ICT into online learning, teaching, and assessment.

Literature review.

The successful implementation of online teaching heavily depends on the utilization of various Information and Communication Technology (ICT) tools and platforms that effectively support instructional delivery and promote meaningful interactions between educators and students. One essential ICT platform for online teaching and learning is the Learning Management System (LMS). LMS platforms serve as a centralized hub where educators can organize course materials, distribute assignments, and facilitate communication channels (Ahmed et al, 2023). Through the LMS, students can access learning resources, submit assignments, participate in discussions, and receive feedback from their instructors. The use of an LMS enhances the organization and accessibility of course materials, streamlines administrative tasks, and fosters an interactive and collaborative learning experience. Thus, ICT tools are indispensable in the realm of online teaching, providing educators with the means to deliver effective instruction and create engaging learning experiences for students. Learning Management Systems (LMS), video conferencing platforms, and content authoring tools are just a few examples of the diverse range of technologies that support online education (Ahmad et al, 2023). By leveraging these tools and continuously exploring innovative technologies, educators can optimize their online teaching practices and foster successful learning outcomes in the digital age.

In terms of pedagogical approached that facilitate online teaching and learning, studies have shown that employing varieties of strategies such as the flipped classroom, where students are provided with pre-recorded lectures or readings to review prior to synchronous online discussions or activities (Bishop & Verleger, 2013; Jandrić et al., 2020) are instrumental to optimal learning experiences. Also, the collaborative learning approach, which promotes student engagement and teamwork can be enhanced with the use of Information and Communication Technology (ICT) tools, such as shared documents or video conferencing platforms so that students can collaborate effectively despite physical separation (Dillenbourg, 2017). Further, instructors can enrich the online learning experiences of students by employing the inquiry-based learning through various methods, such as interactive online resources, virtual experiments, and investigations (Kolodner, 2012). That is to say that online teaching

and learning present an opportunity to implement diverse pedagogical approaches that cater to the unique needs and preferences of students. The flipped classroom, collaborative learning, and inquiry-based instruction are just a few examples of the many effective strategies that can be employed to create dynamic and enriching online learning experiences (Bishop & Verleger, 2013; Dillenbourg, 2017; Kolodner, 2012).

The distinct characteristics of online learning, including self-paced learning, asynchronous communication, and multimedia resources, also contribute to its effectiveness and appeal as an alternative mode of education (Moore & Kearsley, 2011; Palloff & Pratt, 2017; Mayer, 2014). By embracing these features, online educators can create dynamic and learner-centered environments that accommodate diverse learners and foster meaningful interactions and engagement. As the field of online education continues to evolve, leveraging these characteristics will be essential in delivering high-quality and impactful learning experiences in the digital era.

Another dimension of the effectiveness of ICT tools in online teaching and learning is the interactive nature of the learning experience. Interaction and collaboration are indispensable components of successful online learning, contributing to student engagement, active learning, and knowledge construction (Garrison et al., 2020). ICT tools provide a range of functionalities that enable meaningful interactions, such as discussion forums, video conferencing, and real-time chat. Collaborative activities, supported by shared documents and online group projects, foster peer-to-peer learning, and co-creation of knowledge (Picciano, 2021). Additionally, ICT tools that promote social interactions, like social media platforms and online communities, enhance social presence in virtual learning communities (Gunawardena & Zittle, 2015). By leveraging these tools effectively, online educators can create vibrant and collaborative learning environments that foster both academic and interpersonal growth among students.

Assessment is a critical component of the learning process, and in the context of online environments, various strategies and methods can be employed to effectively gauge students' progress and achievement. These assessment strategies are tailored to suit the digital learning landscape, providing valuable feedback, and measuring learning outcomes. Combining a variety of assessment strategies in online learning ensures a comprehensive evaluation of students' performance and understanding. The integration of formative assessments provides continuous feedback for improvement, while summative assessments offer a comprehensive view of overall achievement (Black & Wiliam, 2018). Authentic assessments, on the other hand, assess students' ability to apply their knowledge in practical settings, validating the relevance of their learning experiences (Wiggins, 1993). Thus, by utilizing a diverse range of assessment strategies, educators can gain valuable insights into students' learning outcomes and create an effective and inclusive online learning experience.

In the digital era, Information and Communication Technology (ICT) tools have revolutionized the landscape of online assessment, offering a plethora of options to enhance the evaluation process for both educators and learners. These tools cater to various aspects of assessment, from providing immediate feedback to promoting authentic and efficient evaluation. This means that, ICT tools can significantly enrich online assessment practices, by providing a wide range of options for educators to evaluate student performance effectively. Online quizzes and automated grading systems offer immediate feedback, e-portfolios promote authentic assessment, and online rubrics and grading tools ensure consistency and efficiency (Gikandi et al., 2011; Barrett, 2022; Brookhart, 2013). By leveraging these tools thoughtfully, educators can implement fair and effective assessment strategies that align with the pedagogical goals and promote student success in the digital learning landscape.

Student satisfaction with the use of ICT tools is an important aspect to consider in online education. Research has shown that when students perceive ICT tools as user-friendly, effective, and supportive of their learning, it positively influences their overall satisfaction (Picciano, 2017). Factors such as ease of use, accessibility, responsiveness, and the availability of technical support contribute to students' satisfaction with ICT tools (Wang, 2008). Additionally, the ability of ICT tools to enhance learning experiences, promote engagement, and facilitate collaboration can significantly impact student satisfaction (Panda & Mishra, 2017).

However, pre-service teachers' readiness to engage in online teaching, learning, and assessment is dependent on their attitudes towards and effectiveness of ICT tools (Butakor, 2023). Thus, a positive attitude and effectiveness of ICT tools will promote a worthwhile online teaching, learning, and assessment experience for pre-service teachers. Currently, majority of pre-service teachers frequently

use technological devices in their daily lives but the use of such devices for online teaching and learning becomes problematic sometimes (Sailer et al., 2021). To address this problem, the educational technology (ICT) devices and tools employed during online teaching, learning, and assessment should be less sophisticated and helpful (Scherer & Teo, 2019).

A number of studies have investigated the effectiveness of ICT integration into online teaching, learning, assessment and challenges (Ghavifekr & Rosdy, 2015; Ghavifekr et al., 2016; Kaur, 2023; Suleiman et al., 2020; Samoylenko et al., 2022). For instance, a study by Ghavifekr and Rosdy (2015) on the effectiveness of ICT integration revealed that ICT integration has great impact on both teachers and the students. It was further revealed in the study that one of the factors for successful and effective technology-based teaching and learning was teachers with adequate and well-equipped training with ICT tools. Similarly, Samoylenko et al. (2022) revealed that ICT tools are effectively used by university teachers to manage the online teaching and learning experiences for students. In terms of challenges of ICT integration in online teaching, learning, and assessment, it was revealed that lack of resources, time, lack of effective training, teachers' lack of competency and limited technical support were the key challenges (Ghavifekr, et al., 2016; Kaur, 2023). All these studies were focused mainly on university and in-service teachers from other jurisdictions and context and therefore, it will be instrumental to examine the views of pre-service teachers on the effectiveness of ICT tools deployed for online teaching, learning, and assessment in one the teacher education universities in Ghana.

Methods and material.

In this study, the survey method under the quantitative research design was adopted due to its effectiveness, time saving characteristics, and convenient means of collecting information from many sources (Fraenkel & Wallen, 2006). To select participants for this study, a simple random sampling procedure was used to select 301 pre-service teachers based on the Krejcie and Morgan table (Krejcie & Morgan, 1970) from a target population of about 1,500 pre-service teachers from one of the teacher education universities in Ghana.

The instrument used for data collection was a researcher-made questionnaire made up of closed ended items scored on a 5-point Likert scale ranging from 1=strongly disagree to 5=strongly agree. The questionnaire was divided into three sections. Section one was about the purpose of the data collection and the study, consent declaration and ethical considerations as well demographic information. Section two collected information on the effectiveness of ICT tools on online teaching, learning, and assessment. Finally, section three collected information on the challenges of using ICT tools for online teaching, learning, and assessment. Prior to the main data collection, the research instrument was piloted which led to the modification of the final questionnaire. The final questionnaire was made up of 35 items that yielded a very high reliability coefficient of 0.98.

For ethical consideration, approval was given by the Humanistic Ethics Committee of the University. Also, consents were obtained from participants by ensuring that they were fully aware of the study's purpose and procedures before agreeing to participate. Complete anonymity and confidentiality were also ensured such that no personal information such as names or ID were collected during the study. Also, the rights of the participants were respected and protected throughout the study's cycle. Finally, SPSS version 25 was used for data analysis through both descriptive and inferential statistics techniques.

Results.

The results from the analysis of the demographic characteristics are displayed in Table 1.

Table 1. Demography of the respondents.

Variable	Frequency	Percentage (%)
Gender		
Male	157	52.2%
Female	144	47.8%
Age		
18-20	71	23.6%
21-23	184	61.1%
24 +	46	15.3%

Table 1. Continuation.

Level		
100	23	7.6%
200	48	15.9%
300	96	31.9%
400	134	44.5%

As presented in Table 1, out of a total of 301 pre-service teachers, 157 (52.2%) were males whiles 144 (47.8%) were females. In terms of age, majority of the pre-service teachers, 184 (61%) were aged between 21-23. Similarly, in terms of level of study, the results indicated that majority of the respondents 134(44.5%) were in level 400 (final year).

To examine the effectiveness of ICT tools used in the online teaching, learning, and assessments, the mean and standard deviations of the various sub-constructs were computed, and the results are shown in Table 2.

Table 2. Effectiveness of ICT tools on online teaching, learning, and assessment.

Sub-construct	**Mean**	**Standard Deviation**
Online Teaching	4.1652	.89259
Online Learning	4.1566	.84773
Online Assessment	4.1224	.87146

As shown in Table 2, responses from the pre-service teachers indicating their viewpoints on the effectiveness of ICT tools on online teaching, learning, and assessment were generally high and positive. The mean of 4 out of 5 suggests that on average pre-service teachers considered the incorporation of ICT into online teaching, learning and assessment to be very effective. Also, the relatively low standard deviation of 0.89, 0.85, and 0.87 for online teaching, learning, and assessment respectively indicate that the ratings were clustered closely around the mean. This suggests a high level of agreement among the respondents regarding the effectiveness of ICT tools for online teaching, learning, and assessment. The consistency in ratings further supports the notion that there is a shared belief among the pre-service teachers that ICT tools are beneficial and contribute positively to their online learning experiences.

The study also sought to identify challenges pre-service teachers encounter when using ICT tools for online teaching, learning and assessment. The results of the data analysis of the challenges are presented in Table 3. The results revealed that all the items in the challenges section of the questionnaire were identified as hurdles in the utilization of ICT tools for online teaching, learning, and assessment. The highly ranked challenges were disruptions in online teaching and learning due to technical issues, inability of online teaching and learning to support certain types of assessment, unreliable internet connections, unequal and non-inclusivity of online teaching and learning, and lack of student engagement and motivation due to lack of physical presence.

Table 3. Challenges of using ICT tools for online teaching, learning and assessment.

		Mean
CQ1 - requires a high level of technical expertise.	301	3.98
CQ2 - Reliable internet connectivity is a challenge.	301	4.11
CQ3 - Requires significant time and effort from educators.	301	4.03
CQ4 -Technical issues and glitches disrupt the teaching and learning process.	301	4.21
CQ5 - pose challenges in maintaining academic integrity and preventing cheating.	301	3.99
CQ6 - Lack of access to necessary hardware and software.	301	4.13

Table 3. Continuation.

CQ7 - Inadequate training and professional development opportunities.	301	3.87
CQ8 – Online teaching and learning may not fully support hands-on- and practical learning experiences.	301	3.98
CQ9 - Online challenges and collaboration among students can be challenging.	301	4.03
CQ10 - Insufficient technical support	301	4.00
CQ11 - Ensuring equal access and inclusivity is a challenge.	301	4.11
CQ12 – Online teaching and learning may not fully support certain types of assessments.	301	4.20
CQ13 - Challenge in ensuring data privacy and security.	301	4.03
CQ14 - Lack of physical presence can impact student engagement and motivation.	301	4.08

To test for mean differences across the various demographic characteristics on effectiveness of ICT tools on online teaching, learning, and assessment, independent t-test and One-way ANOVA were conducted. The results of the One-way ANOVA as presented in Table 4 only revealed significant differences in viewpoints across age categories. The analysis did not reveal any significant differences in terms of gender and level of study.

Table 4. Results of One-way ANOVA between age groups and effectiveness of ICT tools.

	18-20		21-23		24+			
Variable	M	SD	M	SD	M	SD	*F* (2, 297)	*P*
Teaching.	4.40	.82	2.97	1.69	2.20	.68	5.91	.003
Learning.	4.20	.80	3.80	1.80	4.00	.89	3.82	.023
Assessment.	3.80	1.02	3.70	0.87	4.30	1.3	3.92	.021

The one-way ANOVA results as displayed in Table 4 provides information about the differences between age groups for three different dependent variables: learning, teaching, and assessment. The table shows the significance level for each dependent variable. The results indicated that there is a significant difference between at least two groups of pre-service teachers' viewpoints on the effectiveness of ICT tools on online teaching, learning and assessment.

Table 5. Tukey HSD Posthoc analysis between age groups and effectiveness of ICT tools.

Dependent Variable	(I) AGE	(J) AGE	Mean Difference (I-J)	Sig.
LEARNING	18-20	21-23	1.45377	.355
		24 and above	3.95377*	.017
	21-23	18-20	-1.45377	.355
		24 and above	2.50000	.113
	24 and above	18-20	-3.95377*	.017
		21-23	-2.50000	.113
TEACHING	18-20	21-23	.79057	.628
		24 and above	3.83405*	.003
	21-23	18-20	-.79057	.628
		24 and above	3.04348*	.008

Table 5. Continuation.

	24 and above	18-20	-3.83405*	.003
		21-23	-3.04348*	.008
ASSESSMENT	18-20	21-23	.80075	.381
		24 and above	2.28445*	.015
	21-23	18-20	-.80075	.381
		24 and above	1.48370	.095
	24 and above	18-20	-2.28445*	.015
		21-23	-1.48370	.095

The Tukey HSD posthoc analysis revealed significant differences between the ages of 24 and above and the other age categories when it comes to effectiveness of ICT tools for online teaching. This indicates that individuals in the 24 and above age group have significantly higher scores when it comes to their viewpoints about effectiveness of ICT tools for online teaching compared to individuals in the younger age groups (18 – 20, and 21 – 23). Similarly, the posthoc analysis also revealed significant mean differences between pre-service teachers aged 24 and above and those aged 18 – 20 in favour of 24 and above age group. On the contrary, posthoc analysis revealed significant mean differences for online assessment between 24 and above and 18-20 age categories in favour of those aged 18 – 20. This suggests that individuals in the 24 and above age group have significantly lower scores when it comes to online assessment compared to the younger age group of 18-20.

Discussion of results.

The study aims to explore the effectiveness of ICT tools for online teaching, learning, and assessment at one of the teacher education universities in Ghana. The results revealed that on average pre-service teachers considered the integration of ICT into online teaching, learning and assessment as very effective and beneficial to their academic growth. This finding aligns well with previous studies that examine the effectiveness of integration of ICT in online teaching, learning and assessment from the perspectives of university and in-service teachers (Ghavifekr & Rosdy, 2015; Ghavifekr et al., 2016). The result further reveals some interesting generational differences in how pre-service teachers perceive the use of ICT tools for online education. When it comes to the effectiveness of ICT tools for teaching, older students (age 24 and above) had significantly more positive perceptions compared to their younger counterparts (age 18-20 and 21-23). This suggests that mature learners find greater value in how technology enables and enhances online instruction, while younger students favour them for assessment. Having more life experience and self-directed learning skills, older students may be better equipped to take advantage of the autonomy and self-pacing that ICT tools facilitate for teaching. This finding is consistent with Hu, et al., (2021) who found that mature distance learners were highly appreciative of the self-paced and self-directed learning afforded by online education technologies. A similar pattern emerges for learning effectiveness, with the oldest age group of 24 and above viewing ICT tools as more beneficial for improving their learning experience compared to the youngest age group of 18-20. The integrative, multimedia resources enabled by technology appear to resonate with mature learners as they enrich their knowledge acquisition and retention. However, for assessment, the reverse is true - younger students aged **(**18-20**)** rated the effectiveness of ICT tools significantly higher than those aged 24 and above. This finding contradicts the findings of Hu et al.(2021)) who concluded that older students had greater acceptance of ICT tools in teaching, learning and assessment. The mixed results indicate that generational differences in online education technology perceptions remain a complex issue. As Dillenbourg (2017) highlighted, implementing student-centered pedagogies tailored to learners' unique needs and perspectives is key to effective online instruction. Further research on multi-generational learning preferences could provide additional insights to help educators optimize technology integration across ages.

This study reveals that pre-service teachers experienced challenges such as “disruptions in online teaching and learning due to technical issues, inability of online teaching and learning to support certain types of assessment, unreliable internet connections, unequal and non-inclusivity of online teaching and learning, and lack of student engagement and motivation due to lack of physical presence”

when using ICT tools during online teaching, learning, and assessment. This finding is consistent with the findings of Ghavifekr et al., (2016) and Kaur (2022) but in sharp contrast with previous studies such as (Balanskat et al., 2013; Gikandi et al., 2011; Barrett, 2022; Brookhart, 2013; Panda & Mishra, 2017).

Conclusion and recommendations.

In conclusion, this study's major findings are:

- Most respondents perceive ICT tools as effective for online teaching, learning, and assessment. However, older students perceive ICT tools as more effective for teaching/learning but less for assessment.
- Main challenges include technical, access, training, academic integrity, support, and engagement issues.

It can therefore be recommended that:

- There is the need for educators to use diverse and tailored pedagogical approaches when integrating technology, rather than taking a one-size-fits-all approach. Activities and assessments should be designed keeping generational perspectives in mind.
- Professional development for teachers should include training on how to effectively use technology to enhance learning for both digital naive students and mature learners. Understanding generational differences can help educators select appropriate tools.
- Course developers creating online content or LMS platforms must include features and interfaces suitable for users across age groups, avoiding bias toward younger digital native students.

Universities need to invest in technologies proven to provide value for specific demographics - E.g., asynchronous discussion boards to support mature distance learners.

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