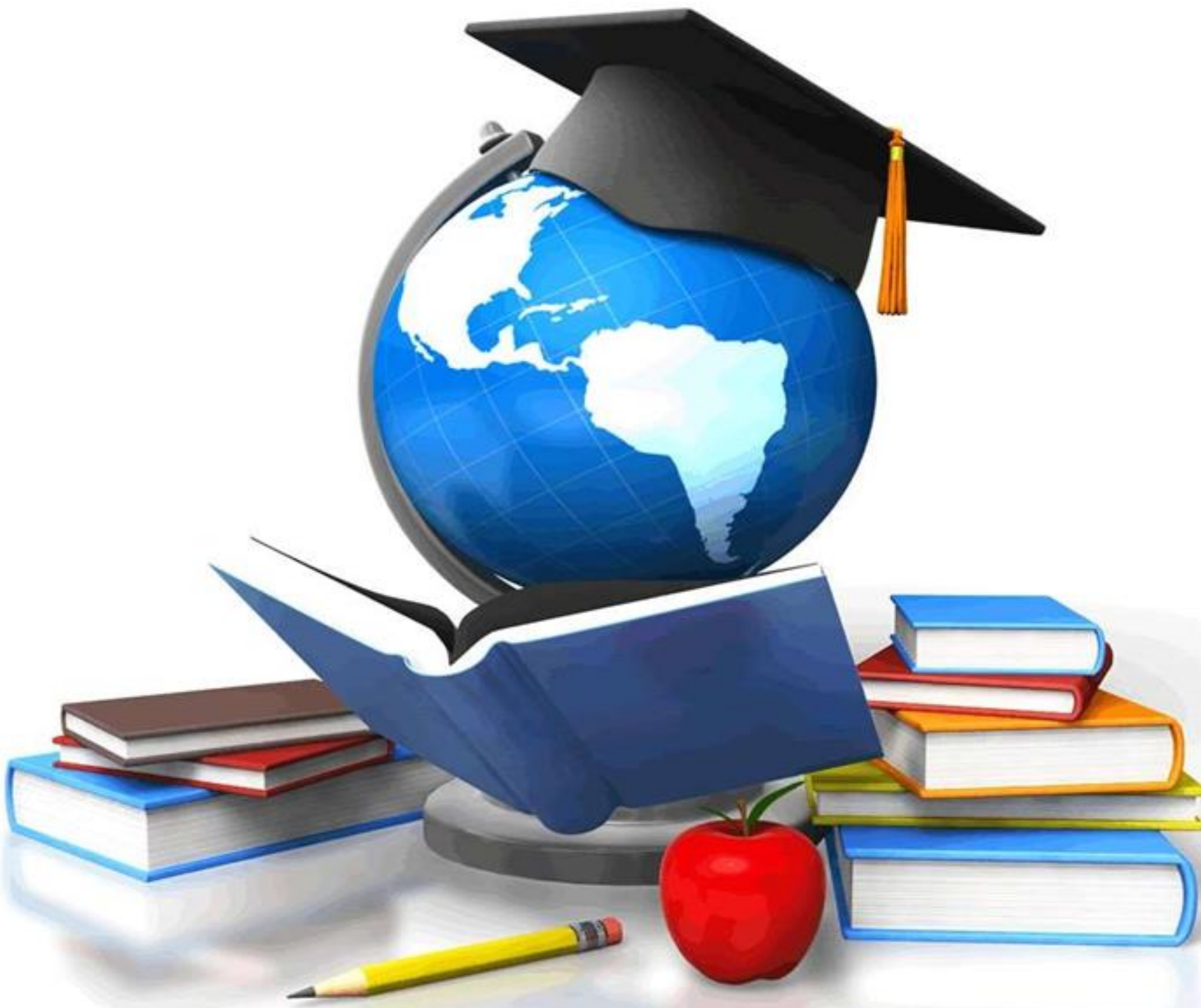
Journal of
Education and Practice
(JEP)

Evaluating ICT Integration and Gender Equality in Physics Education among Ugandan Teacher Trainees



CARI Journals

Journal of Education and Practice
ISSN 2520-467X (Online)
Vol.9, Issue No.1, pp. 1 – 26, 2025 www.carijournals.org

Evaluating ICT Integration and Gender Equality in Physics Education among Ugandan Teacher Trainees

[1]Dr. Waninga Willy, [1]Mr. Olinga John Paul, [1]Mr. Opus Michael, [1]Ms Ajuko Annah Grace

[1]Lecturer Soroti Teacher Training Institute, Uganda, East Africa

https://orcid.org/0009-0007-2701-9499

Accepted: 4th Dec, 2024, Received in Revised Form: 19th Dec, 2024, Published: 6th Jan, 2025

Abstract

Purpose: This study assessed the ICT competences of student teachers and their application in physics education. It aimed to explore their preparedness to utilize ICT in teaching and learning physics, focusing on gender disparities and systemic inequalities in access to resources and training. The study was framed within the Technological Pedagogical Content Knowledge (TPACK) model, Diffusion of Innovations (DOI), and sociocultural theories.

Methodology: The study employed a qualitative approach using survey and case study designs. Data were collected through surveys, document analysis, observations, and interviews with science student teachers enrolled in a Diploma in Education program. Content and thematic analysis was used to analyze the data, providing a comprehensive understanding of the participants' ICT competences and their applications in physics education.

Findings: The findings revealed that student teachers possess foundational ICT skills, including integrating technology into lesson planning and conducting online research. However, gender disparities in competence levels and systemic barriers, such as unequal access to training and technological infrastructure, were evident. These factors hindered equitable ICT integration in physics education and limited the effective utilization of technology for teaching and learning.

Unique Contribution to Theory, Practice, and Policy: The study emphasized the need for targeted curriculum reforms to integrate ICT effectively and address gender disparities. It highlighted the importance of professional development initiatives to equip educators with advanced ICT skills and foster digital literacy. The findings provide valuable insights for policymakers to develop strategies aimed at reducing systemic inequalities and ensuring inclusive, technology-enhanced learning environments in physics education.

Key words: *ICT competences, Physics Education, Gender Disparities, Digital Literacy And Technology Integration*

1.0 Introduction

1.1 Background

In the contemporary era, Science, Technology, Engineering, and Mathematics (STEM) fields are central to driving technological innovation and economic development. Costa et al. (2020) emphasize that STEM disciplines are pivotal for shaping future work landscapes, fostering economic progress, and alleviating poverty (Kiconco & Karyarugokwo, 2022). Among these, physics plays a foundational role as a gateway to numerous STEM careers, significantly contributing to national development (Maera, 2016). Ensuring quality physics education is therefore critical, requiring that students are both effectively taught and thoroughly understand the subject (Bogere et al., 2013).

Quality education, as defined by Irwin (1967) and cited by Kiconco (2022), involves optimizing educational systems to prepare students for adulthood, equipping them with skills for citizenship, employment, and interpersonal interactions while reducing unemployment. In Uganda, a science-led strategy was adopted to promote national growth, including policies mandating compulsory study of Mathematics, Chemistry, Biology, and Physics at the Ordinary level since 2005 to achieve widespread scientific literacy (Uganda-UNESCO, 2010; Wedgwood, 2005).

Despite these efforts, physics is often regarded as a challenging subject, leading to poor performance and low enrolment rates, particularly among female students (Adyemo, 2010; Odaga, 2020; Akambi, 2003). This gender disparity is concerning, as physics education offers critical frameworks for understanding the physical world and applying scientific principles across sectors (Maera, 2016). Factors such as gender biases and the lack of female role models further discourage women from pursuing physics, resulting in low representation in STEM fields (Dujanga et al., 2019).

The integration of Information and Communication Technology (ICT) in education has emerged as a strategy to enhance teaching and learning. ICT facilitates understanding of abstract concepts, making physics more accessible and engaging (Heng & Jing, 2012; Narinderrit, 2020; Ellermeijer & Tran, 2019). However, the Gender Digital Divide (GDD) poses a significant challenge, with fewer women having access to technology and internet resources compared to men (Plan International, 2022; ITU, 2022).

Teacher Training Institutions (TTIs) in Uganda are pivotal in equipping educators with the ICT competences necessary for modern teaching. These institutions play a critical role in implementing science education reforms and addressing gender disparities through gender-sensitive training and resource allocation (Yucel & Kocak, 2010; Kubrickya & Castkova, 2015). Policies such as the National Teacher Policy (NTP) and the establishment of the Uganda National Institute of Teacher Education (UNITE) by the Ministry of Education and Sports

Journal of Education and Practice
ISSN 2520-467X (Online)
Vol.9, Issue No.1, pp. 1 – 26, 2025 www.carijournals.org

(MOES) underscore the government's commitment to integrating ICT and addressing gender inequities in teacher training (MOES, 2018).

Nevertheless, the low enrolment and performance of female students in physics remain significant concerns. This study seeks to investigate the ICT competences of physics student teachers by gender and compare their ability to use ICT to improve physics achievement in TTIs in Eastern Uganda. By understanding these dynamics, the study aims to develop targeted interventions to bridge the gender gap and ensure equitable access to quality STEM education for all students.

1.2 Problem Statement

Physics education in Uganda faces numerous challenges, including low enrolment rates, poor performance, and persistent gender disparities. Studies by Mulhall & Daniel (2019), Adyemo (2010), Odaga (2020), and Akambi (2003) highlight the widespread difficulties students face in physics, which result in underrepresentation and underachievement, particularly among female students (Bello, 2002; UNEB, 2020). Additionally, the limited number of female physics teachers, as emphasized by Dujanga (2019), compounds the gender gap, reducing role models for aspiring female students. While STEM education and ICT integration have been promoted as strategies to enhance teaching and learning, there is insufficient evidence on how lecturers in Teacher Training Institutions (TTIs) incorporate ICT and address gender disparities in physics education (Chaman & Sangay, 2016; MOES, 2018).

This study specifically addresses the gender variable by investigating the ICT competences of physics teacher trainees and analyzing the extent to which these competences and ICT use vary by gender. It also examines how lecturers in TTIs incorporate gender-sensitive approaches in their teaching practices and the strategies they employ to bridge gender gaps in physics education. By exploring these aspects, the research seeks to provide actionable insights for improving ICT integration and fostering gender equity in physics education in TTIs in Eastern Uganda. The findings aim to support the development of inclusive and effective physics education policies and practices that address both technological and gender-based barriers.*(*

1,3 Objectives of the Study

This Research study was guided by the following research objectives:-

1. To investigate the ICT competences possessed by physics student teachers in Teacher Training Institutions in Eastern Uganda, with a focus on gender differences.
2. To determine the extent to which physics student teachers use ICT in learning physics in Teacher Training Institutions in Eastern Uganda, considering variations by gender

1.3 Rationale

The rapid advancement of technology in the 21st century has made ICT an indispensable tool in education, particularly in STEM fields (OECD, 2015). Physics, being a fundamental component of STEM, plays a crucial role in shaping the scientific and technological capabilities of a nation (UNESCO, 2017). However, the persistent gender disparity in physics education, especially in Uganda, raises concerns about equitable access to STEM opportunities for all students (Dujanga, 2019). Integrating ICT in physics education has the potential to simplify complex concepts, foster engagement, and improve learning outcomes for both male and female students (Chaman & Sangay, 2016). Therefore, it is essential to investigate the current state of ICT competences among physics teacher trainees in Uganda and understand how these competences impact their ability to teach and learn physics effectively. By addressing these issues, this study aims to contribute to the development of more inclusive and effective physics education practices in Ugandan Teacher Training Institutions (TTIs).

2. Literature Review

2.1 ICT Competencies among Physics Student Teachers

The gender gap in ICT access and skills is a significant issue in Sub-Saharan Africa. According to the **Global Gender Gap Report (2022)**, men are 21% more likely to access the internet than women, a stark contrast to 52% in developed countries. This disparity highlights the need for physics lecturers in Teacher Training Institutions to assess ICT skills by gender to enable the planning of gender-sensitive lessons. Researchers such as Cheryl and Laura (2009) and Saha and Zaman (2017) stress the importance of understanding gender and ICT dynamics in education. They suggest that physics lecturers must consider students' life histories and socio-cultural backgrounds when planning ICT-integrated lessons.

ICT Self-Efficacy and Gender Differences

Self-efficacy, as discussed by **Bandura (1997)** and supported by **Hatlevik & Christopher (2016)** and **Zhai et al. (2021)**, plays a significant role in how students interact with ICT. Self-efficacious students tend to persist longer and achieve better results. Research indicates that self-efficacy in ICT is influenced by technology experience, socioeconomic background, and gender. Female students often report lower self-efficacy in physics and mathematics, despite outperforming their male counterparts academically (Mumporeze & Prieler, 2017; Schun et al., 2004). This trend suggests that physics lecturers should leverage ICT to bridge the gender gap by creating opportunities for engagement and knowledge sharing, fostering an inclusive learning environment.

ICT Support and Gender Disparities

Recent studies by **Peliez-Sanchez and Glasserman-Morales (2023)** and **Hatlevik et al. (2016)** reveal significant gender differences in ICT skills, with female students often rating their ICT

Journal of Education and Practice

ISSN 2520-467X (Online)

Vol.9, Issue No.1, pp. 1 – 26, 2025 www.carijournals.org

knowledge and skills lower than their male peers. This highlights the need for institutions to provide targeted ICT support for female students to improve their digital competence. Additionally, **Zhao et al. (2021)** argue that students' experiences with technology, shaped by support from teachers, parents, and peers, play a crucial role in enhancing their ICT self-efficacy.

Factors Affecting ICT Competence

A student's ICT self-efficacy is positively related to their computer experience, access to technology, and attitudes towards ICT use (Varoy et al., 2023; Rizal et al., 2021). Exposure to digital media is essential for developing the knowledge and skills required for future STEM careers (Acheta Arrabal et al., 2021). According to **Prieto et al. (2020)**, physics lecturers have a responsibility to prepare students for the knowledge society by teaching them ICT literacy and digital communication skills. The development of ICT competencies can also enhance critical thinking and problem-solving skills, vital for learning physics (Koskivaara & Somerkoski, 2020).

2.2 Use of ICT Competencies in Learning Physics Education

ICT Integration in Teaching and Learning

Effective integration of ICT in education is essential for improving learning outcomes. **Sadaff et al. (2016)** and **Senapati et al. (2022)** stress the importance of educational leaders overcoming resistance to ICT integration. Teachers' attitudes towards ICT use are influenced by several barriers and enablers, including access, skills, and interest (Gunes & Bahman, 2018). Gender disparities in ICT use are also apparent, with male teachers typically using more technology in teaching than female teachers (Mumporeze & Prieler, 2017). This suggests that gender differences in ICT use among both students and lecturers may be a barrier to achieving ICT integration in physics education.

Barriers and Enablers of ICT Use

Umzeyimana et al. (2018) identify traditional teacher-centered approaches as a barrier to the effective use of ICT in physics education. Conversely, approaches that encourage self-managed learning with technology have been found to be more effective. **Jurmani et al. (2021)** and **Siemens (2017)** emphasize that students' knowledge is increasingly connected to technology, implying that physics lecturers need to help students understand and use various technologies for learning. **Koskivaara & Somerkoski (2020)** and **Osborn & Hennessey (2008)** underline the need for appropriate tool selection and fostering interaction with content through technology.

Mobile Learning and Virtual Learning Tools

Vandi & Djebbari (2011) and **Pelseze & Glasserman-Morales (2023)** recommend the integration of mobile learning and flexible teaching strategies to promote cooperative and contextual learning. **Bijgana & Capseka (2012)** advocate for the use of simulations and virtual experiments in physics education to help students grasp complex concepts. Furthermore, **Ra et**

al. (2016) and **Ancheta-Arrabal et al. (2021)** argue that ICT-enhanced learning promotes collaboration, communication, and engagement, which are key components of effective physics education.

Interactive Learning with ICT

Technologies such as clickers can significantly enhance student participation, attentiveness, and engagement in physics lessons (Swenson & Rhoads, 2019). The integration of ICT not only supports teaching but also fosters an interactive and responsive learning environment. **Chen et al. (2011)** and **Zhao et al. (2021)** highlight the value of mobile resources for providing immediate assistance, supporting self-regulated learning, and enhancing ICT competences in physics education.

2.3 Theories Used in Guiding the Study

This study adopted a multi-theoretical framework integrating Technological Pedagogical Content Knowledge (TPACK), Diffusion of Innovations (DOI), and Sociocultural Theory to investigate ICT competences and usage among physics student teachers. These frameworks were chosen to provide a nuanced and multifaceted understanding of the factors shaping ICT integration in physics education. The TPACK framework, developed by Koehler and Mishra (2009), emphasizes the interconnectedness of teachers' knowledge in three domains: technology, pedagogy, and content. TPACK identifies effective ICT integration as requiring not only technical proficiency but also the ability to align technology with pedagogical strategies and disciplinary content to enhance learning outcomes (Alayyar et al., 2019). This study applied TPACK to examine how physics student teachers integrate ICT into their teaching, ensuring alignment with the subject-specific needs of physics education.

Rogers' Diffusion of Innovations (DOI) theory (2017) explores how new ideas and technologies are adopted and diffused within a population. DOI identifies factors such as relative advantage, compatibility, complexity, trialability, and observability that influence the rate of adoption (Unaldi, 2020; Yurdakul et al., 2020). By applying DOI, the study investigated the factors that promote or hinder ICT adoption among physics student teachers, offering insights into the systemic and individual challenges in adopting educational technologies.Vygotsky's Sociocultural Theory (1978) highlights the role of social interactions, cultural norms, and the broader sociocultural context in shaping learning and behavior (Daniels, 2016; Wertsch, 1991). This framework was used to contextualize how social and cultural influences affect the use of ICT in teacher training institutions, emphasizing the importance of collaboration, mentorship, and shared practices in fostering ICT competences.

By integrating these theories, the study captured the technical, pedagogical, and social dimensions of ICT use, providing a comprehensive framework for understanding the complex dynamics influencing physics teachers' ICT competences and their application in education. This multifaceted approach ensured a holistic exploration of ICT integration, addressing individual capabilities, systemic challenges, and contextual influences.

3 .Methodology

This study employed a qualitative research design to explore the ICT competences and adoption among physics student teachers. A case study approach was used, involving observations of ICT integration in physics classrooms, interviews with 46 physics student teachers, and the analysis of lesson plans and curriculum documents. Additionally, surveys were administered to 12 administrators and 12 physics lecturers, who responded to questionnaires designed to provide insight into institutional support and pedagogical practices related to ICT in physics education.

Purposive sampling was used to select participants, ensuring representation of both male and female student teachers, as well as relevant administrators and lecturers. The inclusion of administrators and lecturers allowed for a broader understanding of the institutional environment in relation to ICT adoption. Reliability of the tools was ensured through internal consistency, where the interview and survey questions were designed to consistently address all research aspects. Test-retest reliability was achieved by re-interviewing a subset of participants to verify consistency in their responses. Additionally, survey instruments used for administrators and lecturers underwent pilot testing to ensure clarity and consistency in capturing the intended data.

Validity was established through multiple approaches: face validity was ensured by pilot testing the interview and survey instruments; content validity was established through expert review, ensuring the tools comprehensively covered the study's focus; and construct validity was enhanced by aligning the research tools with the study’s theoretical framework on ICT adoption and competences. Furthermore, triangulation of data from interviews, observations, surveys, and document analysis was employed to ensure a holistic understanding of the phenomena. Data analysis involved thematic analysis and content analysis. Thematic analysis was used to identify and interpret patterns in the interview, survey, and observation data, while content analysis was employed to systematically analyze the frequency of key themes in textual data, such as interview responses, survey results, and lesson plans. Descriptive statistics, including frequencies and percentages, were used to present the occurrence of specific themes across the data.

Ethical approval was obtained from the Busitema University Faculty of Health Sciences Research Committee (BUFHSERC) and the Uganda National Council of Science and Technology (UNCST). Informed consent was obtained from all participants, ensuring their understanding of the study’s purpose and their right to withdraw at any time. Confidentiality and anonymity were maintained by assigning codes to participants and securely storing the data

4. Presentation and Discussion of Results

4.1 ICT Competences Possessed by Student Teachers

4.1.1 Nature of ICT Competences Possessed by Student Teachers

When Physics student teachers were asked on the ICT competences they possess, several views were given which were later coded to come up with categories. These categories formed the themes which were quantified as seen in Table 1 below.

Table 1 Self-Reported Responses on ICT Competences Possessed by Physics Student Teachers

Self-Reported ICT Competences Possessed by Student Teachers	Frequency	Percentage (%)
Digital literacy	16	34.8
Basic computer skills	28	60.9
Knowledge of educational software and tools	15	32.6
Proficiency with digital communication tools	18	39.1
Production of media content	10	21.7
Information management skills	15	32.6
Online research skills	19	41.3
Adaptability to new technologies	08	17.4
Integration of ICT in lesson planning	20	43.5
Assessment and feedback provision using technology	04	8.7
Remote teaching skills	10	21.7
Cyber security awareness	05	10.9

Source: Primary Data

The study on ICT competencies among physics student teachers highlights the progress made in integrating technology into teaching, but also reveals significant gender disparities. The analysis based on TPACK (Technological Pedagogical Content Knowledge) and DOI (Diffusion of Innovations) theories, shows that while many student teachers are proficient in ICT integration, there is a gender gap, especially in areas such as lesson planning, online research, and digital communication. Men generally have more access to and confidence in using technology, contributing to this divide.

Teacher Training Institutions (TTIs) should adopt gender-sensitive approaches to ICT training, ensuring equal opportunities for female students to develop their ICT skills, especially in lesson planning. The integration of ICT in lesson planning was identified as the most prevalent competence, with 43.5% of student teachers reporting proficiency in this area. This aligns with TPACK principles, but the gender gap in this competence requires attention. According to the Global Gender Gap Report (2022), a digital divide exists in Sub-Saharan Africa, where men are more likely to access and utilize technology compared to women. TTIs should prioritize gender-sensitive ICT training, providing additional support for female students to build confidence and proficiency in integrating technology.

Similarly, online research skills and proficiency with digital communication tools were reported by 41.3% and 39.1% of student teachers, respectively. These competences are vital for accessing and utilizing digital resources and communicating in online environments. However, Varoy et al. (2023) note that female students often report lower ICT self-efficacy due to limited access to digital resources and societal norms discouraging girls from pursuing STEM fields. TTIs should implement programs to encourage female student engagement with technology early in their training, providing mentoring and peer-support networks.

Basic computer skills and digital literacy, reported by 60.9% and 34.8% of student teachers, are foundational competences that enhance confidence in navigating digital environments. Despite this, the Global Gender Gap Report (2022) identifies a gender digital divide, with girls and women in Sub-Saharan Africa less likely to have consistent access to the internet. TTIs must prioritize equitable access to digital devices and internet connectivity for female students, ensuring they have opportunities to develop digital literacy skills. Gender-sensitive digital literacy programs should also address cultural and societal barriers. Other competences, such as information management, media content production, and adaptability to new technologies, also show significant gender differences. Peláez-Sánchez and Glasserman-Morales (2023) found that female students often rate their ICT knowledge and skills lower than their male counterparts, reflecting a lack of confidence and societal influences that deter girls from pursuing technical skills. Addressing this requires hands-on opportunities for female student teachers to engage with technology in meaningful ways. Workshops, hackathons, and collaborative projects involving both male and female students can help bridge the confidence gap and foster a more inclusive learning environment.

Remote teaching skills and cyber security awareness, though reported by fewer student teachers, are crucial in the digital learning environment. As digital learning continues to expand, ensuring that both male and female student teachers are well-versed in these competences is essential. Zhao et al. (2021) emphasize that the quality of students' computer experiences influences their development of computer self-efficacy. TTIs should offer targeted resources and training in these areas, particularly addressing the needs of female students in cybersecurity and remote teaching to help them overcome barriers to equal participation. In conclusion, addressing the gender digital divide in ICT training requires focused interventions, equal access to resources, and a supportive environment that encourages female students to develop their ICT competencies.

4.1.2 Comparison of ICT Competences Possessed by Student Teachers by Sex

The analysis of ICT competences among male and female physics student teachers reveals gender disparities influenced by both individual experiences and broader societal trends. While both genders demonstrate essential ICT skills, gaps persist, particularly in technical skills and device usage, highlighting the need for interventions to ensure equal access to technology.

Information Searching and Research Competence emerged as a key strength for both male and female students. Female students, such as BS7 and BS9, and male students, such as CS5 and BS3, reported using ICT tools for research purposes, such as Google and online platforms like Google Scholar. Both genders demonstrate proficiency in these essential research skills, which are crucial for academic success. However, barriers to technology access, particularly for female students in regions where access is gendered, remain a challenge. Efforts must be made to ensure that female students have equal opportunities to develop these critical research skills, promoting academic achievement.

Communication and Sharing Information revealed gendered differences in ICT usage. Female students reported more frequent engagement with communication and collaboration tools, such as Google Drive, WhatsApp, and Google Docs. Male students, like CS12, reported using these tools to a lesser extent. This aligns with broader trends where females prioritize communication and collaboration in learning environments, as noted by Saha and Zaman (2017). The stronger emphasis on collaboration by female students suggests they are utilizing ICT to foster cooperation, a valuable skill in both academic and professional settings. However, the gendered pattern underscores the need to promote equal access to communication tools for all students, ensuring both genders can utilize ICT for collaboration and information sharing.

Technical Skills showed a more pronounced gender disparity. Male students reported more advanced competencies in programming and data analysis. For example, AS6 and AS11 shared their use of Python and MATLAB for data analysis and simulations. In contrast, female students, like BS4, reported less familiarity with advanced ICT tools. This gender gap in technical skills aligns with findings by Peláez-Sánchez and Glasserman-Morales (2023), who noted that male students are more likely to engage in activities such as coding and data management. Addressing this gap requires targeted interventions, such as coding workshops and mentorship programs, to encourage and support female students in engaging with technical areas like programming, promoting a more inclusive and equitable learning environment.

Device Usage revealed notable differences between male and female students. While both groups were competent in using devices like smartphones and laptops, female students, such as BS6 and BS4, reported using a broader range of devices, including tablets. Male students, such as CS12, were more focused on using laptops for programming and coursework. This difference reflects the findings of the Global Gender Gap Report (2022), which highlighted disparities in access to ICT tools between genders. Female students, like BS7, noted the need to rely on computer labs when lacking access to devices at home. To address this, institutions should prioritize efforts to ensure equitable access to ICT tools, such as providing loan schemes or more

Journal of Education and Practice

ISSN 2520-467X (Online)

Vol.9, Issue No.1, pp. 1 – 26, 2025 www.carijournals.org

accessible computer labs, ensuring female students are not disadvantaged by limited access to necessary devices.

In conclusion, while both male and female student teachers possess valuable ICT competences, gender disparities persist, particularly in technical skills, device usage, and collaboration. Female students emphasize communication, collaboration, and diverse device usage, while male students show stronger technical skills. Addressing these disparities requires tailored ICT training, equitable access to technology, and support systems that foster gender-inclusive practices. Providing workshops designed with gender equality in mind will ensure all students, regardless of gender, can develop their ICT skills to their full potential. Additionally, lecturers play a key role in reducing gender gaps by offering inclusive ICT training and ensuring all students have access to the necessary resources, creating a more inclusive and equitable educational environment for all.

4.1.3 Lecturers' Role in Developing Students' ICT Skills

When Physics lecturers were asked to mention their role in developing students' ICT Competences, different views were given. Using content analysis views were coded and later assembled into themes which were quantified for tabulation in Table 2 below.

Table 2 ***Content Analysis on*** *Lecturers' Development of Students ICT Competences*

Lecturer' Role (Theme)	Frequency	Percentage (%)
Modelling effective ICT use	05	42
Incorporation of ICT into instruction	07	58
Provision of hands on ICT activities	05	42
Guiding independent research	12	100
Utilization of learning management systems	04	33
Addressing digital ethics and responsibility	03	25

Source: Primary Data

The analysis of data from physics lecturers reveals their critical roles in developing students' ICT competences. Guiding independent research was identified as the most prevalent role, reported by 100% of respondents, aligning with TPACK principles and fostering students' critical thinking, digital literacy, and research skills. Incorporating ICT into instruction followed closely, with 58% of lecturers reporting this role, reflecting both TPACK and DOI principles by integrating technology to enhance teaching and learning. Modeling effective ICT use and providing hands-on ICT activities were each reported by 42% of lecturers, supporting TPACK principles and helping students build digital literacy and confidence. The use of learning management systems was acknowledged by 33% of lecturers, highlighting the need for institutional and governmental support in strengthening ICT use through CPDs for lecturers.

Addressing digital ethics and responsibility was reported by 25% of lecturers, emphasizing the importance of ethical technology use and digital citizenship, reflecting sociocultural theories.

This role helps students develop a critical perspective on technology and its ethical implications. The discussion also references Aladejana (2007), who highlights ICT's role in promoting higher-order thinking and problem-solving. However, Kiven et al. (2018) note that limitations in lecturers' TPACK, particularly in ICT literacy and digital communication, can hinder their teaching effectiveness. This calls for continued training and retraining of physics lecturers and students to improve ICT competences. In summary, the roles identified by physics lecturers demonstrate a comprehensive approach to fostering ICT competences in students. Through guiding research, incorporating ICT, modeling effective use, and addressing digital ethics, lecturers are key in preparing students for success in the digital world.

Related to the above, thematic analysis was also employed to analyze the data by using codes which were common in most statements as seen in Table 3 below.

Table 3 *Themes on Lecturers' Development of ICT Competences among Physics Student Teachers.*

Theme	Codes
Direct Instruction and Practical Engagement	- Direct Instruction in ICT: "Teaching them how to use it" (AL1) - Assignments Involving ICT: "Giving them tasks that involve ICT" (AL1), "Giving them assignments and encouraging them to search for information online" (AL3) - Encouragement for Research Using Smart phone "Encouraging them to research using smart phones" (CL1) - Sending Notes and Assignments Online: "Sending lecturer notes and assignments online" (AL3) - Engagement with ICT in Coursework: "Encourage them to do course works and assignment submission on soft copy" (CL1)
Encouragement and Access to Technology	- Encouragement to Purchase Technology: "Encourage them to buy laptops, smart phones" (AL1) - Access to Computer Laboratory: "I allow student teachers to access the computer laboratory" (BL1) - Submission of Coursework and Assignments in Soft Copy: "Encourage them to do course works and assignment submission on soft copy" (CL1)
Attitude and Continuous Engagement	- Developing Positive Attitudes Towards ICT: "Developing positive attitudes concerning the use of ICT" (AL1) - Continuous Engagement with ICT: "Ensures that student teachers are continuously engaged in using ICT in their learning" (AL1) - Empowering Student Teachers: "Encouraging them to search for information online" (AL3)

The thematic analysis of how physics lecturers support student teachers in developing ICT skills revealed three primary themes: **Direct Instruction and Practical Engagement**, **Encouragement and Access to Technology**, and **Attitude and Continuous Engagement**. These themes, supported by field evidence, provide valid and reliable insights into the teaching strategies employed by lecturers.

The first theme, **Direct Instruction and Practical Engagement**, emphasizes the importance of deliberate teaching strategies in developing ICT competencies. Lecturers engage in direct instruction on ICT integration and provide hands-on experiences, such as encouraging students to search for information online and complete assignments using ICT tools. This approach aligns with Zhao et al. (2021), who advocate for targeted teaching to address varying competence levels, and Koskivaara and Somerkoski (2020), who highlight the role of ICT in fostering higher-order thinking skills. The second theme, **Encouragement and Access to Technology**, underscores the role of access and motivation in ICT skill development. Lecturers actively encourage students to acquire personal technology, such as laptops and smartphones, and provide access to computer laboratories for practice. This aligns with Peláez-Sánchez and Glasserman-Morales (2023), who emphasize the importance of institutional support, especially for female students, and Varoy et al. (2023), who note that access to technology positively impacts students' self-efficacy.

The third theme, **Attitude and Continuous Engagement**, focuses on fostering a supportive environment for ICT learning. Lecturers strive to develop positive attitudes toward ICT use and ensure continuous engagement, particularly to overcome potential cultural or gender-based barriers. Mumporeze and Prieler (2017) argue that cultural influences can impact students' confidence in technology, especially among girls, and Zhao et al. (2021) emphasize the importance of continuous engagement in improving technology efficiency. In conclusion, these three themes—Direct Instruction and Practical Engagement, Encouragement and Access to Technology, and Attitude and Continuous Engagement—demonstrate the multifaceted strategies used by physics lecturers to develop ICT skills among student teachers. These approaches, supported by both field evidence and scholarly literature, highlight the importance of targeted teaching, resource accessibility, and fostering positive attitudes in preparing student teachers for the digital demands of modern education.

4.1.4 Websites Used by Lecturers for Planning Physics Lessons

When physics lecturers' documents were analyzed to find out the different websites used for preparing their lessons, the following website presented in the Table 4 below were discovered.

Table 4 Websites Consulted by Physics Lecturers Based on Documentary Analysis

Website	Frequency	Percentage
Phet interactive simulations	04	33.3
Khan academy	05	41.7
Physics classroom	04	33.3
American Association of Physics Teachers	06	50
Share ability Uganda	04	33.3
Digital teachers Uganda	02	16.7

Source: Primary Data

The analysis of websites consulted by physics lecturers reveals their preferences and strategies for accessing educational resources. **Phet Interactive Simulations** and **Physics Classroom**, each accessed 4 times (approximately 10% of total consultations), were popular due to their interactive simulations and comprehensive tutorials. **Khan Academy**, consulted 5 times (about 12.5%), was frequently accessed for its extensive collection of educational videos and exercises, including in physics, providing valuable supplementary material. The **American Association of Physics Teachers (AAPT)** website, consulted 6 times (15%), emerged as a key resource, likely due to its role as a professional organization offering a variety of resources and professional development opportunities for physics educators. Local resources such as **Shareability Uganda** and **Digital Teachers Uganda** were consulted 4 times (10%) and 2 times (5%), respectively, highlighting the interest in context-specific resources tailored to the Ugandan educational landscape. This diverse selection of websites illustrates lecturers' proactive approach to accessing both international and local resources to enrich their teaching and improve students' learning experiences in physics. These findings align with Zhao et al. (2021), who stress the importance of using diverse online resources for enhancing teaching and learning in the digital age.

4.2 Presentation of Findings on Student Teachers' Use of ICT in Learning Physics

4.2.1 Relationship between Students' ICT Use and Learning Achievement

The analysis of responses from student teachers and administrators regarding the relationship between ICT use and learning achievement revealed several key themes, supported by field evidence.

The first theme, the **ubiquity of ICT in education**, was emphasized by student AS8, who stated, "technology is indispensable in today's world." Student teachers highlighted that familiarity with ICT tools directly influenced their academic performance, with Administrator AA1 noting, "Students with prior ICT competences tend to outperform their peers, as they can leverage digital tools to research and complete tasks more efficiently." This supports the idea that ICT tools like Google are essential for completing assignments and communicating, aligning with Ra et al. (2016), who assert that ICT fosters collaboration, interaction, and teamwork, improving learning outcomes.

The second theme, **collaborative learning through ICT**, emerged from responses about how digital tools facilitated peer interaction and collective problem-solving. AS8 shared, "Using ICT tools like WhatsApp and Google Docs allows us to work together on projects, exchange ideas, and solve problems more effectively." BS5 added, "Being confident with ICT allows me to engage in group discussions and help my classmates understand how to use digital platforms." This aligns with Ra et al. (2016), who emphasize that ICT encourages collaboration and interaction, enhancing academic performance.

A critical theme brought forward by BS5 was the **dual nature of ICT use**, where it can either support or detract from learning. BS5 noted, "Sometimes I use ICT tools to research for my assignments, but I can get distracted by social media or YouTube." This highlights the challenge of digital distractions, emphasizing the importance of responsible ICT use. Student teachers observed that increased familiarity with ICT tools boosted their confidence but also introduced the temptation of non-educational content. Nhungu (2012) highlighted similar concerns, suggesting the need for digital literacy to foster responsible ICT use in academic settings.

The fourth theme, **prior ICT competence as a predictor of academic success**, was evident in responses from administrators. AA1 emphasized, "Students who are already proficient in ICT tools tend to excel academically because they can engage in independent learning and quickly adapt to new educational technologies." AA3 added, "Students with strong ICT skills are more likely to help their peers and engage in self-regulated learning, which significantly improves their academic performance." These insights support Zafar & Khan (2017), who argue that students with strong ICT skills are better able to understand academic concepts and succeed in their studies.

Administrator AA4 further highlighted that ICT enhances **multi-sensory learning**, noting, "When students use ICT tools like simulations and interactive videos, they engage multiple senses—sight, hearing, and touch—making learning more immersive and effective." Many student teachers also observed that interactive learning tools, especially in subjects like physics, improved their understanding of abstract concepts. This is consistent with Mayer (2005), who found that multi-sensory environments supported by ICT improve comprehension and retention.

Finally, the correlation between **ICT competence and academic achievement** was emphasized by both lecturers and administrators. AL1 stated, "Students who actively use ICT tools for research, presentations, and assignments tend to have higher grades." AA3 added, "Students without strong ICT skills often struggle to complete digital assignments, which can negatively affect their grades." These reflections validate the significant link between ICT competence and academic success, supporting the TPACK framework by Mishra & Koehler (2006), which stresses the integration of technological, pedagogical, and content knowledge to improve educational outcomes

4.2.2 Lecturers' Concerns in the Use of Technology in Addressing Gender Differences

Table 5 *Showing Lecturers' Concerns on Gender in integrating ICT in Teaching*

Concern	Frequency	Percentage (%)
Experiential learning	04	33.
Conducting class discussion	12	100
Cooperative learning	06	50
Inquiry based instruction	07	58.
Students led instruction	10	83.
Proper seating arrangement	08	67
Giving wait time to ladies	03	25
Ensure quality and equity	06	50
Gender sensitive language	03	25
Use of variety of ICT tools	03	25

Source: Primary Data

The analysis of the roles physics lecturers play in developing students' ICT competencies revealed several key themes. **Guiding independent research** was the most prevalent role, reported by 100% of respondents. This is typically facilitated through class discussions, where students are encouraged to engage in social interactions and thorough consultations before presenting their findings. This aligns with Scot (nd), who advocates for guided participation through social activity, emphasizing the importance of interaction between students and lecturers to foster cognitive development. It also aligns with TPACK principles, promoting independent inquiry, critical thinking, and digital literacy.

The **incorporation of ICT into instruction** was identified by 58% of respondents and aligns with the TPACK principle. By integrating ICT, lecturers support innovation adoption, using technology to enhance teaching and learning, which helps engage students in meaningful activities (Rabach, 2015). **Modeling effective ICT use** and **providing hands-on ICT activities**, reported by 42% of respondents each, are also crucial roles. These practices reflect TPACK principles and foster students' digital literacy and confidence in using technology for problem-solving and learning (Makanda, 2015).

Additionally, **addressing digital ethics and responsibility**, reported by 33% of respondents, emphasizes the importance of promoting ethical technology use. This role draws on sociocultural theories, highlighting educators' responsibility to guide students' ethical behavior and digital citizenship (Redmond, 2015). By addressing these issues, lecturers help students develop critical perspectives on technology use.

In conclusion, the roles identified by physics lecturers show a multifaceted approach to developing ICT competencies, including guiding research, incorporating ICT into instruction, modeling effective technology use, providing hands-on activities, and promoting digital ethics.

Journal of Education and Practice

ISSN 2520-467X (Online)

Vol.9, Issue No.1, pp. 1 – 26, 2025 www.carijournals.org

These strategies are crucial in fostering students' digital literacy and preparing them for success in the digital world (Ringstaff & Kelly, 2002).

4.2.3 ICT Competences Used by Student Teachers in Learning Physics

Analyzing the ICT competences used by student teachers in learning physics provides insights into their digital literacy skills and the extent to which technology is integrated into their learning experiences as put in the Table 6 below. When Physics lecturers were asked on the competences student teachers use in learning physics, several views were presented.

Table 6 *ICT Competences Used by Student Teachers in Learning Physics*

ICT Competence	Frequency	Percentage (%)
Searching Information	08	67
Storing Information	05	42
Uploading and Downloading Documents	05	42
Using Power Point	07	58
Using Excel to Draw Graphs and Work out Calculations	02	17
Making Instructional Materials	04	33
Creating Contents	03	25
Programming Computers	00	00
Problem Solving	01	8.3

Source: Primary Data

The most prevalent ICT competence reported by student teachers is searching for information, with 66 % of respondents indicating its use (Tondour et al, 2011). This suggests that student teachers frequently rely on digital resources to gather information related to their physics studies, highlighting the importance of information literacy skills in accessing and evaluating online content. Following closely behind are competences related to using PowerPoint, reported by 58 % of respondents, and storing information and uploading/downloading documents, each reported by *42%* of respondents (Fraillon, 2014). These competences reflect students' engagement with presentation software and file management tools, indicating their ability to create and organize digital materials for learning purposes.

In contrast, competences such as using Excel for graphing and calculations, making instructional materials, and creating content are reported by fewer student teachers, ranging from 17% to 33 % (Hatlevik et al, 2016). While these competences are valuable for enhancing learning experiences and creating educational resources, their lower prevalence suggests potential areas for further development and integration of technology into teaching and learning practices. Moreover, competences such as programming computers and problem-solving are reported by very few student teachers, with only 8% and 0% of respondents indicating their use, respectively. This indicates a limited engagement with more advanced ICT skills that are relevant for computational thinking and problem-solving in physics education. Addressing these competences could enhance students' ability to leverage technology for analytical tasks and complex problem-solving challenges.

4.2.4 Benefits of Incorporating ICT and Gender in Physics Learning

The analysis of student teachers' responses in Table 7 on the benefits of incorporating ICT and gender considerations into physics education highlights several key insights.

Table 7 *Responses from Student Teachers on Benefits of Incorporating ICT and Gender in Physics Learning*

Benefit	Frequency	Percentage (%)
Promotion of student intellectual abilities	41	89.1
Provision of opportunities for investigation	39	84.9
Simplifying physics content	43	93.5
Improving communication skills	37	80.4
Transforming teaching and learning	45	97.8
Understanding learning tools	33	71.7
Developing creativity and problem solving skills	29	63.
Allows students to monitor their own learning	40	85.9

Source: Primary Data

The overwhelming majority of student teachers (97.8%) believe that ICT integration transforms teaching and learning, making physics education more dynamic, interactive, and engaging. This underscores the significant impact of technology in enhancing the educational experience. Additionally, ICT has the potential to bridge gender gaps, especially for female students who may face challenges in traditional educational settings.

The second most frequently cited benefit (93.5%) is that ICT simplifies complex physics content. By leveraging digital tools, educators can break down difficult concepts, making the subject more accessible and inclusive, particularly for female students who often encounter barriers in physics. The use of ICT can create an environment where both male and female students are better able to engage with the content and succeed.

Other benefits mentioned by student teachers include promoting intellectual abilities (89.1%) and providing opportunities for investigation (84.9%). These benefits reflect how ICT fosters critical thinking and problem-solving skills, which are vital for success in physics. Importantly, these benefits are equally transferable across genders, enabling both male and female students to be empowered in their learning.

These findings align with previous research, such as Thompson (2000), who emphasized the potential of ICT to empower both male and female students when viewed through a gender-sensitive lens. Medichie (2019) highlighted how new technologies revolutionize teaching and learning, supporting the notion that ICT can serve as an equalizer in education. Habbler (2016) also found that integrating ICT and gender considerations improves student understanding and achievement in science, reinforcing the idea that ICT can reduce gender disparities by providing equal learning opportunities

4.2.5 Approaches Used in Incorporating ICT and Gender in Learning

The analysis of student teachers' responses on the approaches used by physics lecturers to incorporate ICT and gender considerations into teaching reveals three main strategies: integrated, enhancement, and complementary approaches.

Table 8 *Responses from student teachers on Approaches Used by Lecturers in Incorporating ICT and Gender in Learning*

Approach	Frequency	Percentage (%)
Integrated approach	26	56.5
Enhancement approach	12	26,1
Complementary approach	08	17.4
Total	46	100

Source: Primary Data

The most common approach, used by 56.5% of respondents, is the integrated approach, which aligns with Koskivaara and Somerkoski (2020), who emphasize selecting ICT tools that complement learning content. This approach ensures equal access to technological resources for both male and female students, thus helping reduce gender-related barriers. As noted by Mumporeze and Prieler (2017), gender disparities often arise from unequal access to technology, with male students typically using it more than female students. The integrated approach helps to create a more equitable learning environment.

The enhancement approach, employed by 26.1% of respondents, aims to improve traditional teaching methods with ICT. This strategy enhances learning experiences but requires careful attention to gender differences in ICT engagement. Singh (2017) and Mumporeze and Prieler (2017) highlight that female students may face barriers in using ICT, and lecturers adopting this approach must ensure equal engagement from all students, especially females, to foster inclusivity.

The complementary approach, used by 17.4% of respondents, involves using ICT alongside traditional teaching methods. While this approach can enrich learning, it must also address gender disparities in technology access. UNESCO (2004) advocates for learner-centered teaching, where ICT complements traditional methods and promotes equal participation. However, if female students face obstacles in accessing or using ICT, the complementary approach may not fully mitigate gender disparities. Senapati et al. (2022) stress the need for overcoming these barriers to ensure equitable engagement for both genders.

These findings underscore the importance of adopting gender-sensitive strategies to ensure equal access to ICT tools, fostering an inclusive learning environment where all students can succeed.

4.2.6 Approaches Used by Physics Lecturers in Teaching

The strategies employed by physics lecturers to integrate gender considerations and ICT into teaching are essential for creating an inclusive and gender-equitable learning environment.

Table 9 *Showing Responses from Student Teachers on ICT Applications Used in Learning Physics*

Application Used	Frequency	Percentage (%)
Simulation Software	21	45.7
Learning Management Systems	19	41.3
Online Collaboration Platforms	15	32.6
Podcast and Video Lectures	18	39.1
Digital Text Books and E-Books	32	69.6
Webinars and Virtual guest speakers	10	21.7
Educational Applications for Mobile Devices	40	86.9
Online Journals and Science Blogs	06	13.
Social Media Platforms	32	69.6

As shown in Table 9 below, the most common approach is the integration of gender-inclusive language, reported by 83.3% of lecturers. This strategy, grounded in sociocultural theories, reduces gender biases in education by using neutral language such as "students" or "they," which ensures both male and female students feel valued and represented. The second most common approach, used by 50% of lecturers, involves blended learning environments and educational applications and games. These strategies align with TPACK principles, combining technological, pedagogical, and content knowledge to create interactive learning experiences. Blended learning caters to diverse learning styles and ensures equal engagement opportunities for both genders, while educational games and applications can help boost engagement, especially for female students who may feel less confident in traditional settings.

Other approaches include the use of online collaboration projects and the customization of learning materials, reported by 33% of lecturers. These strategies promote collaborative learning and personalized instruction, ensuring all students, regardless of gender, can benefit from ICT-enhanced learning. By fostering teamwork and knowledge sharing, these approaches promote gender equality in the classroom. Additionally, 42% of lecturers reported using flipped classroom models, and 33% use social media platforms. These student-centered approaches encourage students to take ownership of their learning and collaborate outside of class, which can be particularly empowering for female students, who may face lower participation in traditional lecture-based formats.

4.2.7 ICT Applications Used by Students in Learning Physics

Understanding the ICT applications used by student teachers in learning physics is essential for tailoring teaching methods to suit diverse learning styles. Table 10 highlights various ICT applications used in physics education, providing insight into the tools that students find most useful in their learning.

Table 10 Approaches Used by Physics Lecturers in Incorporating ICT and Gender in Teaching

Approach	Frequency	Percentage (%)
Inclusive Curriculum Design	02	17
Use of Interactive Simulations and Virtual Labs	04	33
Online Collaboration Projects	04	33
Blended Learning Environment	05	42
Integration of Gender –Inclusive Language	10	83
Implementation of Flipped Classroom Models	05	42
Utilization of Educational Applications and Games	06	50
Customization of Learning Materials	06	50
Implementing Universal Design of Learning	04	33
Incorporation of Social Media and Online Platforms	04	33
Continuous Evaluation and Feedback	02	17
Collaboration With Diversity and Inclusion Initiatives	02	17

Source: Primary Data

Among the most widely used applications are digital textbooks and e-books (69.6%), educational applications for mobile devices (86.9%), and social media platforms (69.6%). These applications offer students flexible, interactive, and engaging ways to access course materials and collaborate with peers, contributing to a more inclusive and equitable learning environment. Simulation software (45.7%) and learning management systems (41.3%) are also commonly used, enabling students to conduct virtual experiments and access course materials in an organized and efficient manner. These tools are particularly valuable for fostering active learning and providing students with opportunities to engage in practical, hands-on experiences that can enhance their understanding of physics concepts.

While podcasts and video lectures (39.1%) and online collaboration platforms (32.6%) are less frequently used, they still contribute to creating a diverse range of learning opportunities for students. These resources allow students to engage with course material in different formats, catering to a variety of learning preferences and needs. Despite the widespread use of these applications, the successful integration of ICT in physics education depends on both external and internal enablers, such as access to technology, technical support, and the availability of training programs. These factors must be carefully considered to ensure that all students, regardless of gender, have equal access to ICT tools and resources. Educators and stakeholders must work together to remove barriers and create a more inclusive, gender-sensitive learning environment in which all students can thrive.

4.3 Conclusion

The assessment of ICT competences among physics student teachers revealed both strengths and gaps essential for modern teaching practices. While many student teachers demonstrated foundational ICT skills, such as integrating technology into lesson planning and creating engaging digital learning environments, significant gaps were observed in advanced competencies, including programming, media content creation, and remote teaching. Additionally, gender disparities in ICT skills highlight the importance of tailored training programs to address the specific needs of male and female student teachers. To fully prepare future physics teachers for technology-enhanced classrooms, educational institutions must implement targeted professional development initiatives that address these gaps, ensuring more inclusive and effective teaching practices.

4.4 Implications for Theory, Practice, and Future Research

The findings have important theoretical, practical, and research implications. Theoretically, the study reinforces frameworks like TPACK, which highlights the need for integrating advanced ICT tools into subject-specific teaching, and Self-Determination Theory, which emphasizes the role of digital literacy in fostering autonomy and motivation. Practically, there is a pressing need for professional development programs to build advanced ICT skills, curriculum redesign to incorporate tools like simulation software and learning management systems, gender-specific training to address disparities, and digital literacy initiatives to manage technology use effectively. For future research, exploring barriers to advanced ICT competence, assessing the impact of ICT skills on teaching effectiveness, investigating gender-specific factors influencing ICT use, and evaluating the effectiveness of various ICT tools in physics education will provide valuable insights. These efforts are critical for creating an equitable, technology-driven educational environment that benefits both teachers and learners

References

Aladejana,F(2007).The Implications of ICT and NKS for Science Teaching : Whither Mgera.11e-1fe:complex systems publications.inc

Ancheta-Arrabal, A., Pulido-Montes, C., & Carvajal-Mardones, V. (2021). Gender Digital Divide and Education in Latin America: A Literature Review. *Education Sciences*, 11(12), 804. https://doi.org/10.3390/educsci11120804

Awuor,F.M.,& Okono,E.(2020).ICT Integration in Learning Physics in secondary schools in Kenya: Systematic Literature Review. *Open Journal of Social Sciences*, 10,421-461. https://doi.org/10.4236/jss.2022.109027.

Biljana,Jana & Dijana,C(2012). Integrating ICT into Physics Education: Solving Problems Using Geogebra. Education Conference: 6th International Computer &Instructional

Technology Symposium

Biswajit,D.,Durgesh,T,Sumitha.C&Huma,P(2017).QualitativeMethods:SurveyCommunicationsResearch,*ResearchandMediaandCommunicationStudies*.RetrievedfromResearchGate. https;//www.researchgate.net/publicat/318959206

Bogere,A, Abu,R, & Rahman,M (2013).Improving Performance Of Science Subjects In TVET Institutions By Using Collaborative Learning. Reference To Uganda .International Journal of Engineering Sciences and Research Development, 2(10), October 2013,ISSN:2277-9655.

Charman, V, & Sangay ,D((2016).Gender difference towards ICT Awareness in Indian Universities ,Springer 2016,5,370: Published online 2016 March 74.doi: 10.1186/540064-016-2003-1

Dujanga, F, Saphina, B,& Akoba, R (2019).Trends and Status of Women in Physics in Uganda https://doi.org/10.1063/1.5110112

Heng,L & Lei,L (2012).Emergency Technologies in Learning in the ICT Age .In educational stages and interactive learning : From Kindergarten to workplace training (pp73-99)IGI Global. https//doi.org/10.4018/978-1-4666-0137-6.ch005

Hennesy, S., D'Angelo, S., Mclntyre, N., Koomar, S., Kreimeia, A., Cao, L., Brugha, M., & Zubairi, A.(2022). Technology Use for Teacher Professional Development in Low and Middle Income Countries. A systematic Review. Computers and Education open, 3, Article ID:100080. https://doi.org/10.1016/jcaco.2022.100080.

https://doi.org/10.1007/978-3-030-04924-910.

International Telecommunication Union (ITU) (2022). Bridging the Gender Gap, Geneva

Irma,H& Geert, I, Monique ,V & Admuraal (2009). Gender Inclusiveness in Education Technology and Learning Experiences of Girls and Boys. *Journal of Research on Technology in Education*, JRIE 41(3).253-276

Jumani, N. B., Ajmal, F., Malik, S., & Maqsood, F. (2022). Online Education as a Key to Bridge Gender Digital Divide in Pakistan. *Tenth Pan-Commonwealth Forum on Open Learning*. https://doi.org/10.56059/pcf10.9275

Kevin,S, Darhmauouni ,H, Alauui,C, Bensaid, F, Berrado,A (2008). "Bringing Information Technology to Middle School Instruction in Morocco" Prcoceedings of the 2008 .*International Conference on Technology in Education* (Inted 2008),3-5 March 2008Valencia,Spain

Koskivaara, E., & Somerkoski, B. (2020). Alumni Reflections on Gender Equality in the ICT Context. *Responsible Design, Implementation and Use of Information and Communication Technology*, 12067, 380-386. https://doi.org/10.1007/978-3-030-45002-1_33

Kubrikya,J & Castkova,P(2015).Teachers' ICT Competency & Their Structure as A means of Developing Inquiry Based Education, *Procedia Social and Behavioral Sciences ,Vol.186. Pp882-885*

Madichie,N.O,Taura,N.D.,&Bolat,E.(2019).What next for digital entrepreneurship in sub Saharan Africa? In N.Taura,E. Bolat,& N. Madichie (Eds). Digital Entrepreneurship in Sub Saharan Africa (pp221-240).Palgrave Macmillan

Maera,J(2016).Physics Teaching Methods Module for BED , School of Education, Masai ,Meru University.

Makanda,J,L.(2015).Use of ICT in Teaching Physics :A case of secondary schools in Kimilli schools in Kimilili district ,Bungoma ,Thesis submitted to Kenyatta University.

MOES (2018).National Teacher Policy .Kampala

Mulhall, P. & Daniel, S.(2019). Changing Attitudes to Learning Physics through Participation in the Victorian Young Physicists' Tournament. In Deakin STEM Education Conference 2016 Proceedings.

Mumporeze, N., & Prieler, M. (2017). Gender digital divide in Rwanda: A qualitative analysis of socioeconomic factors. *Telematics and Informatics*, 34, 1285-1293. https://doi.org/10.1016/j.tele.2017.05.014

Odaga, G(2020). Gender in Uganda's Tertiary Education Distribution, *Journal of Social Sciences Humanities, Volume, 2, Issue 1.20201000023.* Accessed on 9th June 2022, Page 100305. https://doi.org/10.1016/jsasaho.2020.100023

Peláez-Sánchez, I. C., & Glasserman-Morales, L. (2023). Gender Digital Divide and Women's Digital Inclusion: A Systematic Mapping. *Multidisciplinary Journal of Gender Studies*. https://doi.org/10.17583/generos.10555

Prieto, J. S., Torres, J. M. T., Gómez García, M., & Gómez García, G. (2020). Gender and Digital Teaching Competence in Dual Vocational Education and Training. *Education Sciences*, 10(3), 84. https://doi.org/10.3390/educsci10030084

Ra, S., Chin, B., & Lim, C.P.(2016). A Holistic Approach towards information and communication Technology (ICT) for Addressing Education challenges in Asia and then Pacific Educational Media International, 53, 69-84. https://doi.org/10.1080/09523987.2016.1211334.

Rabah, J.(2015). Benefits and Challenges of Information and Communication Technologies (ICT) Integration in Quebec English Schools. *Turkish online Journal of Educational Technology-TOJET, 14, 24-31.*

Rizal,R,Rusdiana,D,Setiawan,W,Siahaan,P&Ridwan,IM (2021).Gender Differences in Digital Literacy Among Prospective Physics Teachers ,International Conference on

Saha, S., & Zaman, M. O. (2017). Gender Digital Divide in Higher Education: A Study on University of Barisal, Bangladesh. *IOSR Journal of Humanities and Social Science*, 22(1), 11-17. https://doi.org/10.9790/0837-2201041117

Senapati, C., Sarma, N. N., & Choudhury, S. (2022). Is there Gender Divide in Online Learning? Interpretations from Undergraduate Level Management Education. *Tenth Pan-Commonwealth Forum on Open Learning*. https://doi.org/10.56059/pcf10.3300

Siemens, G.(2017).Connectivism. In R.E. West (Ed), Foundations of Learning and Instructional Design. Ed Tech Books.

Singh, S. (2017). Bridging the gender digital divide in developing countries. *Journal of Children and Media*, 11(3), 245-247. https://doi.org/10.1080/17482798.2017.1305604

Tondeur , j., D, Bill, M., Sulders, M.,& Zhu,C.(2011).Integrating ICT in Kenyan Secondary Schools: An Exploratory Case Study of a Professional Development Programme. Technology, Pedagogy and Education.24, 565-584.

UNEB (2020).Report of Final UACE Results, Kampala

UNESCO (2021). UNESCO Science Report of 2021, Share of Women among Total Researchers by Country.

Uwizeyimana, D., Yadav, L.,Musengimana, T., & Uwamahoro, J.(2018). The Impact of Teaching Approaches on Effective Physics Learning. An Investigation conducted in Five Secondary schools in Rusizi District Rwanda. *Rwandan Journal of Education, 4, 4-14.*

Varoy, E., Luxton-Reilly, A., Lee, K., & Giacaman, N. (2023). Understanding the Gender Gap in Digital Technologies Education. *Proceedings of the 25th Australasian Computing Education Conference*. https://doi.org/10.1145/3576123.3576131

Volman, M & Van Eck, E.(2001). Gender Equality and Information Technology in Education: The Second Decade. Review of Educational Research, Vol.71.No.4.pp.613-634.

Yucel,A.S &Kocak (2010)Evaluation of the Basic Technological Competency of the Teachers' Candidate According to the Various Variables .*Procedia Social and Behavioral Sciences Volume 2 ,Pp 1310-1315.*

Zhao, Y., Pinto Llorente, A. M., Sánchez Gómez, M. C., & Zhao, L. (2021). The Impact of Gender and Years of Teaching Experience on College Teachers' Digital Competence: An Empirical Study on Teachers in Gansu Agricultural University. *Sustainability*, 13(84163). https://doi.org/10.3390/SU13084163