

Harnessing ICT Resources: Empowering Educators and Enhancing Student Skills Through Teacher Training Programs

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Abstract

Incorporating Information and Communication Technologies (ICT) into educational settings has fundamentally transformed pedagogical practices; however, the effective implementation of these technologies within teacher training programs continues to pose significant challenges. This systematic review examines the role of ICT resources in the professional development of educators and their influence on the enhancement of student competencies, with particular attention to frameworks such as the Technological Pedagogical Content Knowledge (TPACK) and the Digital Competence Framework for Educators (Dig Comp Edu). By synthesizing findings from various studies, the review reveals emerging trends, including an increasing focus on digital literacy, critical thinking, and collaborative learning, while acknowledging obstacles such as insufficient infrastructure and limited training opportunities for teachers. The results indicate the transformative potential of innovative technologies, including artificial intelligence and virtual reality, in redefining educational methodologies. Nonetheless, the review highlights notable deficiencies, particularly the necessity for quantitative research to assess the direct effects of ICT on educational outcomes and the restricted scope of teacher training initiatives in addressing contextual challenges. This review highlights the transformative potential of ICT integration in teacher training programs and its essential role in enhancing student skills. The evidence synthesis indicates progress in developing teachers' ICT competencies but also reveals persistent challenges, such as infrastructural inadequacies and a lack of comprehensive quantitative assessments. Recommendations include the formulation of inclusive ICT policies, the expansion of teacher training programs, and the promotion of equitable access to technology in under-resourced areas. This study offers practical insights for educators, policymakers, and educational institutions, underscoring the critical importance of strategic ICT integration to prepare students for the challenges of the 21st century adequately. Future research should prioritize longitudinal studies and investigate the role of ICT in fostering inclusivity and personalized learning experiences.

Keywords: ICT Integration, Teacher Training, Digital Literacy, Emerging Technologies.

Introduction

Technology-enforced acquisition of Information and Communication Technologies (ICT) as tools to support education has become an important phenomenon at the global level due to the increasing technologization and its applicability in education (un Baako & Abroampa, 2023). Policymakers

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globally have widely acknowledged that ICT can improve education performance; hence, many approaches to including ICT in classrooms are evident (Voogt & Tondeur, 2015). Such activities include offering schools technological tools to establish national ICT policies and curriculum frameworks (Tomaro, 2018). The aim is to achieve better learning outcomes and make learning experiences more dynamic and worthwhile – to prepare students for a world that requires 21st-century competencies (Omariba, 2020). However, the process is not always smooth, and ICT integration depends on several aspects, including the infrastructure and the training given to teachers, which then influences the contextual factors of each system (Voogt & Tondeur, 2015; Wang et al., 2022). Research has addressed various degrees and facets of ICT integration in learning and teaching, and whereas some research has found ICT to enhance student learning, some have reported sporadic limitations (Hakimi et al., 2024; Brun & Hinostroza, 2014).

Needs of the Study

ICT is a need of the modern era. Educational institutions are required to fulfil the needs of students physically and virtually. ICT integration in education comprises numerous and diverse horizons of disparities relative to the different countries and the typology of educational settings. ICT usage may be extended in developed countries as there are usual requirements for better infrastructure and teachers' training programs (Becuwe et al., 2017). However, even in these contexts, questions remain about appropriate teaching and learning practices and how to use technology most advantageously within classrooms (Mena et al., 2020). Some of these difficulties are even heightened in developing countries where the availability of resources, Infrastructures, and access to technologies are limited (Voogt & Tondeur, 2015; Wang et al., 2022). The technology gap, both from the internal and international perspectives, remains a challenge to achieving equality in access to technology and related gains (Tomaro, 2018). Adding to this complexity is the fact that ICT integration often occurs across cultural and social contexts (Voogt & Tondeur, 2015), meaning that those specified social requirements need to be met in the given community environments of each country.

Significance of the study

ICT is becoming the backbone of any educational institute due to its needs and benefits. Especially in the days of COVID-19, it played a vital role in managing educational activities. It has been argued that while ICT has massive educational potential, offering schools technologies cannot ensure effective integration (Voogt & Tondeur, 2015; Ngaya et al., 2024). Investigations continue to stress that implementing such technology is predicated on adequate pedagogic training for teachers (Binti et al., 2024; Ngaya et al., 2024). The role of teacher training has been reported to be a significant challenge for integration with calls for sound and context-sensitive professional development programs (Binti et al., 2024; Wang et al., 2022). Such programs should encompass instructional content about the practical use of technology in teaching and learning and pedagogical strategies that use the technologies (Kihzoza et al., 2016), (Tondeur, 2018). Other antecedents that affect the effectiveness of teacher training involve aspects such as the quality of trainers, continuity, and subjecting of teachers to well-developed programs and resources alongside compliance with school practices (Laabidi, 2024).

Teacher training has to apply these notions to the variety of circumstances that exist in the field. This entails equipping the teachers with the right technological competencies and content awareness relating to ICT integration in a classroom (Vyalikova et al., 2019). However, it must also focus on the teaching and learning factors to help teachers build and use technology-integrated

pedagogy or technology-integrated learning activities that conform with the principles of pedagogy and learning outcomes (Tondeur, 2018). Teacher training should also cover specific issues regarding incorporating ICT in current curricula and teaching practices (Kihzoza et al., 2016). In addition, training should build and sustain a culture of CPD (Continuing Professional Development) (Septimo, 2024), which should also support and help the teachers to teach using technology permanently (Ngaya et al., 2024; Laabidi, 2024). Such further assistance is essential to solve these challenges and keep the ICT integration for learning (Laabidi, 2024).

Models and Frameworks for ICT Integration

Numerous models and frameworks have been formulated and articulated to facilitate the integration of ICT in education. In the TPACK framework, technological, pedagogical and content knowledge roles are emphasized to show how technology integration affects the other two domains in creating enriched learning experiences. The Substitution Augmentation Modification Redefinition (SAMR) model (Voogt & Tondeur, 2015; Kihzoza et al., 2016) can be employed to determine the level of integration of technology in learning pedagogical arrangements shifting from the simple substitution to modification or even redefinition. According to the Four in Balance model (Voogt & Tondeur, 2015), the vision, expertise, content applications, and resources for ICT implementation have to be balanced. These frameworks offer practical measures for analyzing the processes of ICT integration in education and enhancing the use of technology in education and learning, but to do so, the strengths of the frameworks must be realized in the context of the specific environments within which educators, policymakers, and researchers are working with (Kihzoza et al., 2016).

Teacher Self-Efficacy and ICT Integration

It has also been established that teacher confidence in effectively apply ICT in teaching is determines technology use (Robertson, 2012). High levels of self-efficacy make teachers use ICT for teaching and learning with appropriate tenacity (Robertson & Al-Zahrani, 2012). Therefore, Teacher training programs should be designed to enhance teacher confidence and self-efficacy in using technology by affording opportunities for practical experience, modelling and peer cooperation respectively (Robertson & Al-Zahrani, 2012; Tondeur, 2018). Meeting concerns about the existing didactic support gap is important to increase teacher acceptance and improve self-efficiency. As for the solutions that were found for this perceptual gap, leadership support and efficient curriculum construction are seen as important (Robertson & Al-Zahrani, 2012).

Teacher Training Models and Approaches

Several methods of teachers teacher training have been discussed, and all of them have advantages and disadvantages. One of the approaches includes academic-orientated training with the use of performance improvement technology training coupled with reflecting practice in a school setting, according to Binti et al. 2024. This approach is applied and is conducted repeatedly so that the teacher can apply ICT in a way appropriate for the context of that class. The second approach uses teacher involvement in the design of ICT-integrated curricular resources, referred to as teachers' design ability by Becuwe et al. (2017) and Tondeur (2018). It takes ownership and is the most effective way of building teachers' capacity through learning and risking together. Cov/r, the training model selected needs to be aligned with the needs and context of teachers and the resources available (Tondeur, 2018). In any case, one of the more essential aspects that the current and future models need to make provision for is the long-term, comprehensive incorporation of ICT teacher

training into continuous professional learning: perhaps, the primary prerequisite for enhancing the optimal use of ICTs in the classroom (Espinosa et al., 2023).

Challenges and Gaps in Teacher Training

Although quality teacher training is necessary to enhance the teaching and learning process, there are some barriers and problems with its realization. A significant issue is the scarcity of funds allocated for teachers' professional learning, especially in the least developed countries (Voogt & Tondeur, 2015). Sustainable developments are rife with financial problems, a lack of access to technology, and a low supply of adequately trained teacher educators. Another area of difficulty is the mislink between preparation courses for the teachers and academia and what teachers face in class. Educational development in training has been found to have little influence on classroom practices due to inadequate focus on the unique technological and pedagogical difficulties encountered by teachers (Omariba, 2020; Ngaya et al., 2024). In addition, there is also the need to find more efficient training strategies and models of training teachers, primarily contextual and sustainable ones. In addition, there is a need to assess the existing teacher training programs for areas of participation and to ascertain if these programs are playing a helpful role in ensuring improved integration of ICT schools (Ngaya et al., 2024).

Therefore, including ICT in education is a multi-faceted and dynamic exercise. There is plenty of evidence that the actual integration of ICT has to encompass a range of dimensions, including infrastructure support, curriculum support, and, most significantly, teacher education. An approach to professional development requires coherence, relevance to teachers' context, and both the technical and didactical aspects of ICT use. Therefore, tackling the challenges and shortages that teacher training faces is critical to capturing the potential ICT to enhance the teaching and learning process and, eventually, the overall educational opportunities worldwide

Research Objectives

1. To systematically review the existing literature on the use of ICT resources in teacher training programs.
2. To identify the specific ICT resources and strategies that have been effective in enhancing student skills.
3. To evaluate the impact of ICT resource integration on student learning outcomes.
4. To explore the challenges and opportunities associated with ICT integration in teacher training and education.

Research Question

How does ICT resource integration impact teacher training programs on student skill enhancement?

Methodology

Assimilating the conceptual framework guiding the exploration of experiences in transformed classrooms entails using rigorous and systematic procedures to search, select, analyze, and combine existing studies.

Research Design

The study employed a systematic review approach to gather, assess, and sum up studies done in the past. It also ensured that evidence was collected systematically about the objectives of ICT resources in education.

Steps in Defining Inclusion and Exclusion Criteria

The criteria for defining the database were clear for inclusion and exclusion of the studies to make sure the best ones were chosen. Criteria included:

- Inclusion: Of the identified articles, 29 met the following specific criteria: published in a peer-reviewed journal from 2000 through the end of each project year, including studies that employed primarily qualitative methods, quantitative, and mixed methods, and published in the English language.
- Exclusion: Those articles that did not primarily concern ICT in education or that failed to report adequate methodological data.

Data Sources

Relevant articles were collected from scholarly indexes such as Dimension, Google Scholar, Scopus, and Web of Science for reliable and high-impact articles.

Search Strategy

The identified Population, Intervention, Comparison, Outcome, and Time factors formed the PICO-Search strategy, which helped to search for the most relevant literature. These terms included ICT and education, ICT digital literacy, ICT training teachers, ICT and students' skills, etc. To refine results, Boolean operators such as AND, OR, and NOT were employed.

Data Extraction

A standardized data extraction form was designed to collect and organize critical information, including systematically

- Author(s)
- Publication year
- Country
- Sample size
- Research design
- ICT resources used
- Student skills targeted
- Key findings

The use of this methodology precluded bias in the review process while making it more repeatable, thus providing a solid ground for synthesizing knowledge on the uses of ICT in education.

Literature Review

Conceptual Framework

This paper focuses on four key components: the integration of ICTs into teaching and learning, teacher education, student learning, and learner status. The TPACK and SAMR theoretical frameworks underpin these aspects.

Teacher Education Programs: The success of ICT integration is closely related to effective teacher education programs. These Program Specific Outcomes (PSO's) are the knowledge, skills and attitudes pre-service teachers need in their classrooms to appropriately incorporate ICT (Becuwe et al., 2017; Tondeur, 2018). Such programs should incorporate approaches promoting TPACK development, for example, drawing teacher educators' TPACK into focus, discussing technology's place, designing ICT embedded resources, working collaboratively, employ real-life scenarios and

feedback (Tondeur, 2018; Becuwe et al., 2017; Tondeur et al., 2018). This learning can be achieved through developing teacher design teams (TDTs) (Tondeur, 2018).

Teacher Competencies: Teachers need comprehensive knowledge about how technology integration interacts with teaching practice and subject matter knowledge, which is TPACK. According to Becuwe et al. (2017) and Baako & Abroampa (2023), these three knowledge domains must be integrated into this framework to enhance ICT integration in teaching and learning. However, the SAMR model helps assess the effect of technology integration by comparing how technology modifies or redesigns conventional teaching practices by substituting, amplifying, transforming or redefining them (Kihzoza et al., 2016).

ICT Infrastructure and Resources: Whoever attempts to understand this topic cannot deny that access to the basic requirements of Information and Communications Technology (ICT) is fundamental; they are hardware, software, dependable connection to the internet and necessary digital contents (ITEST, 2022; Dibaba, 2017; Wang et al., 2022). Sufficient and appropriate instrumentations, packaged in forms that are easy for the teachers to learn and use and aligned with the intended curriculum-specific learning objectives, are important prerequisites for supporting the teacher in enhancing the integration of ICT, as presented in the previous chapters.

Student Learning: ICT plays an important role in learners' performance, and integration is needed as a change component. It facilitates motivation among students, increases information usage, and even improves problem-solving among students (Kihzoza et al., 2016; Abbas et al., 2023). In addition, ICT tools provide the chance to implement individualised and differentiated learning approaches necessary for different learning types (Runge et al., 2023).

Assessment and Evaluation: In this context, some methods for teacher professional development and learning assessment are still missing when evaluating the impact of ICT integration in teaching-learning processes and practice. Referees of TPACK and SAMR models can be used to build the assessment instruments and frameworks that will be used for measuring the progression of teachers' competency or evaluating the efficiency of technology use (Kihzoza et al., 2016; Runge et al., 2023; Wang et al., 2022).

This conceptual framework stresses the role of integrating ICT in teaching and learning, focusing on teacher initial training, resource availability, and the kind and how to measure the effect of ICT on learning outcomes.

Review of the Literature

Prior research has discussed the result of ICT in education, stating that education is not only the enhancement of students' performance (Timotheou et al., 2022). It was found that questioning and short performances performed by teachers are important for understanding students' knowledge and skills and could potentially affect the application of ICT (2). Education technology research has demonstrated that online education efforts can enhance the learning experiences of students (3). Further, cooperation between general and special education teachers is critical in responding to the needs of children with disabilities with assistive technology (4). Teachers' impact on students' achievement has been highlighted in different research, and the advancement of the use of ICT in education is considered primarily (5). Teachers can make a positive addition to their modes of teaching by using multimedia items and collaborative tools so that learners can work on projects in groups and, as a result, learn skills that may be essential in future learning (6). However, numerous published papers on education technology and student use of mobile phones have specifically been subjected to meta-analysis (Antoninus et al., 2023). This literature review emphasized the need to train teachers in using ICT more than just basic skills in education

(Seenivasan, 2024). STEM/ ICT competence development programs, for instance, the Innovative Technology Experiences for Students and Teachers (ITEST), has the vision of improving students' learning proficiency in STEM/ITC by offering novel interventions of education research (Innovative Technology Experiences for Students and Teachers (ITEST, 2022). It has also been seen that various training courses involving ICT in teaching seem to have favourable impacts on students' performance, indicating the importance of the professional development of the faculty (Ghavifekr & Rosdy, 2015).

Trends and Gaps in ICT Integration Research

The previous studies provided an overall view concerning the uses of ICT resources in teacher training programmes and the improvement of skills among the students. Some of the findings help uncover the following: A general perusal of studies shows an increase in papers and emphases on the relevance of ICT in education over the last decade. Nevertheless, a significant limitation in research based on quantitative data is the absence of evidence on the extent to which ICT integration modifies the practices of teaching and learning in classrooms. As so many point out, quality research is required to assess the effect of digital technologies on education (Timotheou et al., 2022; Jayalakshmi, 2024). ICT is part of skill-based education; therefore, it should be included in the curriculum of schools in Pakistan. Curriculum reforms with enough resources are needed in the era of skill-based education (Rafiq-uz-Zaman & Nadeem, 2024).

Trends and Patterns

Shifting Research Focus

An analysis of keywords and terminologies utilized in academic publications over time indicates a notable transition in research priorities. Prior to 2020, the predominant focus of studies was on general information and communication technology (ICT) integration, teacher professional development, and the factors influencing ICT adoption (Baako & Abroampa, 2023).

The onset of the COVID-19 pandemic, however, represented a significant turning point, leading to an increase in research dedicated to examining the role of ICT within online and blended learning environments (Baako & Abroampa, 2023; Timotheou et al., 2022).

Keywords such as "pandemic," "COVID," "digital education," "self-efficacy," and "behavioral intention" have emerged as significant indicators of the evolving educational landscape and shifting research priorities (Timotheou et al., 2022).

Emphasis on Digital Skills Development

Emphasis on Digital Skills Development: Recent studies have increasingly highlighted the importance of developing digital competencies among both educators and learners, acknowledging the necessity of equipping them with essential skills pertinent to the 21st century (Aithal & Aithal, 2023; Jayalakshmi, 2024).

Frameworks such as TPACK and DigCompEdu are increasingly employed to inform professional development initiatives and evaluate teachers' digital literacy (Baako & Abroampa, 2023; Vieira & Pedro, 2023).

Growing Interest in Emerging Technologies

Growing Interest in Emerging Technologies: A discernible trend has emerged towards investigating the integration of emerging technologies, including artificial intelligence, virtual reality, and learning analytics, within teacher training programs (Aithal & Aithal, 2023). This trend

reflects a burgeoning interest in utilizing innovative tools to enhance pedagogical practices and tailor learning experiences to individual needs. Information and communication technology can help eliminate gender inequality significantly as it effectively empowers women (Rafiq-uz-Zaman et al., 2024).

Need for Comprehensive Evaluation

Need for Comprehensive Evaluation: Although the literature acknowledges the beneficial impacts of ICT integration, there is a recognized necessity for more rigorous quantitative research to assess its effectiveness (Fink, 2019). This underscores the importance of developing standardized outcome measures and conducting extensive evaluations to yield evidence-based insights that inform policy and practice.

Chronological Progression

Foundational Research (Pre-2015)

Previous work has prepared the foundation by investigating the conditions that affect ICT uptake and infusion in learning. Another study explored the teacher knowledge levels, the challenges that influence its adoption and the effectiveness of professional development programs in technology integration (Ghavifekr et al., 2016; Mulhim, 2014).

Expansion of ICT Tools and Platforms (2015-2019)

It also saw the adoption of other forms of ICTs for the professional development of teachers such as Learning Management Systems, Collaboration tools and Multimedia. Research focused on the educational potential of these tools and how they influenced practices (Timotheou et al., 2022).

COVID-19 and the Rise of Online Learning (2020-Present)

ICT integration in education has advanced greatly due to the pandemic by pushing education online as well as the use of the blended model. Major research questions emerged to meet emerging issues and trends in remote teaching practices, including teacher professional development for online instruction and innovation and applications of technology in enhancing students' learning engagement (Timotheou et al., 2022; Timotheou et al., 2022).

Focus on Digital Skills and Emerging Technologies (Present)

Recent research focuses on the ICT competencies of teachers and learners about their continuous professional development by adopting the usage of technology in learning. With the advances in various technologies, there has been a high awareness of what new technologies can do to enhance teaching learning practices (Aithal & Aithal, 2023).

In general, the sources point to a rapidly changing body of knowledge as it relates to the application of ICT resources and their role in teacher training and the development of students' skills. Although previous efforts have shown cause-effect relationships for the indices that determine ICT integration and its perceived value, more rigorous quantitative research is needed to establish ICT's effects assertively. Subsequent studies should aim at creating comparable indicators of outcome and undertaking louder evaluations to enhance understanding of policy and practice.

Results

Study Characteristics

Table 1: A summary table of the included studies that explicitly detail qualitative assessment results, including key characteristics

Author(s)	Publication Year	Country	Sample Size	Research Design	ICT Resources Used	Student Skills Targeted
Kilag et al.	2024	Philippines	Not given	Phenomenological	Not specified	Lifelong learning competence
Robertson & Al-Zahrani	2012	Saudi Arabia	325	Interviews	Not specified	ICT integration in teaching, teacher self-efficacy
Taheri et al.	2024	Not given	Not given	Thematic analysis	Not specified	Digital literacy

This table only includes studies from the sources that explicitly provided qualitative assessment results. Several other sources mention qualitative research approaches but don't provide specific details on the findings.

Quality Assessment

While many of the sources present some qualitative research methodologies, few of them give details of the qualitative assessments made.

- Kilag et al. (2024) conducted a phenomenology study to identify the perception of faculty members on the competency-based lifelong learning education in teacher education programs
- A study by Kilag et al. (2024) employed a phenomenological approach to investigate faculty views on the effectiveness of teacher education programs in developing lifelong learning competence. The authors discovered that, in the opinion of the faculties, these programs address the intended goals, further supporting the concerns regarding appropriate and efficient applied pedagogy for lifelong learning.
- Robertson and Al-Zahrani (2012) employed the use of interview questions that were semi-structured with pre-service teachers to establish their perceived self-efficacy in the integration of ICT in their teaching.
- A study by Kilag et al. (2024) employed a phenomenological approach to investigate faculty views on the effectiveness of teacher education programs in developing lifelong learning competence. They found that faculty members generally perceive these programs as effective, highlighting the importance of incorporating pedagogical practices that foster continuous learning.
- Robertson and Al-Zahrani (2012) conducted semi-structured interviews to understand pre-service teachers perceived self-efficacy in integrating ICT into their teaching. According to their research, they concluded that although the pre-service teachers demonstrated relatively high levels of self-efficacy beliefs, they still need support and training on how to integrate technology into their classes.

Student Perspectives

Taheri et al. (2024) employed thematic analysis to study students' narratives of the digital literacy process. Their study showed that students are worried about difficulties in the process of digital learning and at the same time admitted the possibilities and prospects in future learning. Anticipated concerns were related to technical support and challenges experienced when managing learners - self-regulatory learning in online environments. Possible advantages described the convenience and the availability of electronic materials for the learning process.

All in all, from the presented sources, there is little qualitative data presented, but the few findings imply a positive attitude towards ICT resources in education, indicating the importance of continuing the support, training and provision of resources as necessary for successful implementation. The studies should focus more on further collection of deeper quality data on teachers' and students' use of technologies blended into teaching and learning processes.

Thematic Analysis

Theme 1: Effective ICT Resources and Strategies in Teacher Training and Student Skill Enhancement

One such element as mentioned above is that applying Information and Communication Technologies in education is not an easy task, as it demands an effective integration of resources into the teaching-learning process and the choice of the proper approach to it. Some works provide descriptions of specific ICT tools and techniques that have been useful in improving teacher training and student abilities. For example, to favor the children's PC time, the educational software, designed for preschoolers, may stimulate attention and memory (Iancu, 2023). In higher learning, the use of various software learning platforms, Twitter, and other online information sources improves preservice teacher learning (Ngao et al. 2022). These results mean that care has to be taken in the selection of ICT supports that meet particular learning outcomes and instructional purposes.

In addition, they have pointed out that the integration of ICT which directly refers to class work and syllabus work is efficient. Such an approach makes sure that the incorporation of technology is appropriate to the achievement of learning goals. Types of enhancements could include basic operating software, subject Software, Web browsing software, Blogging, Integrated learning tools, Wiki, Podcasts, Photo galleries browsers, and Browser enhancement (Dibaba, 2017). It could be said that the choice of technology should be contingent upon the requirements of the students, as well as upon the subject field.

Therefore, in teacher training the integration-oriented approach as opposed to the technology-oriented model plays a vital role when it comes to the design of content. This model is more important because it emphasizes ways in which the instructional use of the technology can enhance teaching and learning as opposed to just featuring the technology. Another strategy is school-based training in conjunction with performance improvement technology and reflective practice (Binti et al. 2024). Such training is advantageous because teachers can apply what they have learnt in their classroom immediately and receive practice feedback. ICT competency that has to be developed among teacher trainees as a precondition of effective ICT integration includes motivational, cognitive, technological, communication-network, and reflexive-axiological components in general pedagogical ICT competency (Vyalikova, 2019). This needs to emphasize completing an effective curriculum of teacher training that integrates content knowledge and teaching training.

Theme 2: Existing problems and organizational factors that limit the integration of ICT in education

However, the enhancement of ICT integration has several challenges that make it difficult to implement as follows; Another point regarding the challenges facing the implementation of the MoU results is that many teachers are not very technical as they lack formal technical education. A case in Kenya, for instance, found that, while teacher training is usually in terms of Lesson delivery and content matter mastery, negligible attention is paid to the use of technology in practice. This implies teacher training where many of the current and would-be teachers are argued to require adequate IT preparation in line with the use of ICT in their teaching practice. In addition, lack of infrastructure including poor internet connection and few devices are also another key challenge that hinders e-learning (Wang, 2022; Omariba, 2020; Ngaya et al. 2024). This is especially the case in rural areas and developing countries often technology is not as easily accessible (Wang, 2022). Besides, infrastructural shortcomings, schools can rarely afford to purchase the required technologies due to financial difficulties (Ngaya et al., 2024) adding difficulties for educators.

The lack of willingness to change on the part of teachers is yet another factor that prevents the integration of ICT for transmission (Ngaya et al., 2024). This can be due to low self-efficacy to use technology, the absence of promoting traditional face-to-face teaching methods, or just simple ignorance about integrating technology into teaching. To overcome this resistance several conditions, have to be met First of all teacher training has to be effective secondly the support needs to continue teachers need to be encouraged to experiment and try out new ideas and approaches. Lack of integration of ICT in the curriculum is also a problem as seen for the following reasons: There is also a problem of integrating ICT as a teaching learning resource hence existing syllabi may contain courses on teaching ICT (Kihzoza et al., 2016). This has somewhat constrained the extent to which ICT may be utilized to influence teaching and learning practices. In addition, insufficient understanding and motivation of sympathetic and strategic leadership and innovative pedagogy can fail ICT integration (Robertson, 2012). This emphasizes the necessity for effective influence from principals and school executives as well as a positive school environment that encourages the use of technology.

Theme 3: Impact of ICT Integration on Student Skills

One of the important research questions is to seek the value added by ICT integration on student skills. Different research has established that ICT integration in teaching and learning can enhance several student skills such as analytical skills, problem-solving skills, innovative skills as well as technical skills in handling ICT products. For instance, the integration of ICT in the teaching of science increases students' participation and their performance outcomes. This idea indicates that ICT can offer opportunities for learning resources and accommodate different learning styles. Further, the use of ICT in instruction enhances collaboration activities and hence develops pupil's interpersonal communication skills (Ngao, 2022). Computer and related technology assist students and their teachers to help them engage the students and their fellow students in real-time conversations the facilitate learning. Also, it plays an important role in the creativity and problem-solving domain where ICT makes learning enjoyable and productive (Hakimi, 2024). The students can utilize technology tools to design projects, envision and develop solutions ideas and generate novel solutions and strategies in tackling a problem. The integration of multimedia especially interactive tools has been revealed to enhance students' learning (Hakimi, 2024). This shows that with the help of ICT, the learner can cultivate higher-order thinking skills. In addition, the use of

ICT helps to enhance students' technological pa, enabling them to possess relevant technological skills to undertake technological activities in their lives and professions effectively. It is especially important in the present world that is characterized by higher reliance on technology in teaching, learning and career pursuits. It is, however, essential to also mention that the IPTA model affects student's skills development based on the degree of ICT integration within the curriculum where some of the factors that mediate the IPTA impacts include the quality of the teacher's professional development, accessibility to resources, and receptiveness to the methods in use (Hakimi, 2024). Thus, planning and, implementation measures require more attention to achieve the most beneficial effects of ICT integration and to have positive effects on all learners.

Integrating ICT in education can therefore be described as a dynamic and complex process. There are however risks and challenges involved which have been discussed in this thematic analysis, to achieve these potential benefits, an understanding of these challenges is quite essential to enhance and support this concept. **CONCLUSION:** ICT integration in the teaching and learning process is most desirable when there is focused effort in teachers' training, provision of teaching resources and effective use of pedagogy. In the same areas, the heads of educational institutions will be able to understand how and use ICT to improve teaching and learning, as well as to prepare students for the global society of the 21st century.

Findings and Future Directions

Key Findings

The systematic review underscores the significant importance of Information and Communication Technology (ICT) resources within teacher training programs and their impact on the enhancement of student competencies. The principal findings are as follows:

1. The integration of Information and Communication Technology (ICT) fosters the development of critical skills, including digital literacy, critical thinking, and collaborative learning among students.
2. Teacher training programs that incorporate frameworks such as TPACK (Technological Pedagogical Content Knowledge) and Dig Comp Edu (Digital Competence Framework for Educators) effectively bolster teachers' capabilities for the adoption of ICT.
3. Various challenges, including inadequate infrastructure, insufficient training, and resistance to change among educators, impede the effective integration of ICT.
4. Emerging technologies, such as artificial intelligence (AI) and virtual reality (VR), present opportunities for innovative pedagogical approaches; however, they require further investigation.

Implications for Practice

The findings yield practical recommendations for stakeholders:

- Educators should prioritize ongoing professional development to enhance their ICT competencies in response to the evolving educational landscape.
- Policymakers ought to formulate policies that guarantee equitable access to ICT infrastructure, particularly in under-resourced areas.
- Teacher training institutions should integrate context-specific ICT training modules that focus on both technical skills and pedagogical strategies for effective integration.

Limitations

This study acknowledges several limitations, including:

- Potential biases stemming from the reliance on English-language publications, which may exclude pertinent studies published in other languages.
- The exploration of the long-term effects of ICT integration is constrained by the diverse methodologies employed in the included studies.
- There is a lack of comprehensive data regarding specific ICT tools and their direct effects on student outcomes.

Future Research Directions

To address existing gaps, future research should:

- Conduct longitudinal studies to evaluate the long-term impacts of ICT integration on teaching and learning outcomes.
- Investigate the role of ICT in fostering inclusivity for marginalized and differently-abled learners.
- Examine the interplay between emerging technologies and pedagogical innovations across various educational contexts.

Conclusion

This review highlights the transformative potential of ICT integration in teacher training programs and its essential role in enhancing student skills. The synthesis of evidence indicates progress in developing teachers' ICT competencies; however, it also reveals persistent challenges, such as infrastructural inadequacies and a lack of comprehensive quantitative assessments.

The integration of ICT is fundamental to contemporary education, equipping students with vital 21st-century skills. Achieving sustainable success necessitates a collaborative effort among educators, policymakers, and institutions to address challenges, harness emerging technologies, and cultivate inclusive, technology-rich learning environments. This collective commitment will unlock the full potential of ICT to revolutionize education and empower future generations.

References

- Aithal, P. S., & Aithal, S. (2023). Empowering Educators Through Digital Pedagogies: Transforming Higher Education. *International Journal of Professional Practice in Children and Youth Services*.
- Antoninis, S., Benavente, F., Delannoy, F., Harvey, J., Leicht, J., Lemoine, A., & Twesigye, A. (2023). *Technology in education: A tool on whose terms?* Global Education Monitoring Report. UNESCO.
- Baako, I., & Abroampa, W. K. (2023). Research trends on ICT integration in Education: A bibliometric analysis. *Cogent Education*, 10(2), 2281162.
- Becuwe, H., Roblin, N. P., Tondeur, J., Thys, J., Castelein, E., & Voogt, J. (2017). Conditions for the successful implementation of teacher educator design teams for ICT integration: A Delphi study. *Australasian Journal of Educational Technology*, 33(2).
- Becuwe, N., Boeve-de Pauw, J., Devos, S., & Struyven, I. (2017). The potential of peer coaching to enhance technology integration in secondary education. *Computers & Education*, 113, 138-149.
- Binti Mohd, R. F., Zulkifli, H., & Hamzah, M. I. (2024). Systematic Literature Review of ICT Integration in Teaching and Learning. *TEM Journal*, 13(4), 3146.

- Binti, M. A. H., Samsuddin, S. F., & Samah, A. A. (2024). Exploring Challenges in Integrating ICT into Teaching and Learning: A Systematic Literature Review. *Sustainability*, 16(1), 252.
- Brun, M., & Hinostroza, J. E. (2014). Latent semantic analysis for the assessment of prior learning. *Educational Technology & Society*, 17(1), 212–222.
- Brun, M., & Hinostroza, J. E. (2014). Learning to become a teacher in the 21st century: ICT integration in Initial Teacher Education in Chile. *Journal of Educational Technology & Society*, 17(3), 222-238.
- Dibaba, W. (2017). The role of effective integration of ICT in education, especially in primary and secondary education of remote settings. *International Journal of Advanced Research in Computer Science*, 8(9).
- Epinosa, R., Garcia, E., & Bagais, C. R. (2023). Evaluating the Performance of Teachers: A Systematic Review of the Existing Literature. *International Journal of Social Science and Humanities Invention*, 10(07), 7597–7606. <https://doi.org/10.18535/ijsshi/v10i07.03>
- Espinosa, M. P., Reomero, J. I., Deguito, P., Lugatiman, R., & Bantilan, J. (2023). Performance Appraisal of Teachers in Public Secondary Schools: A Systematic Review. *International Journal of Research and Scientific Innovation*, 10(11), 356-367.
- Ghavifekr, S., & Rosdy, W. A. W. (2015). Teaching and learning with technology: Effectiveness of ICT integration in schools. *International Journal of research in education and science*, 1(2), 175-191.
- Hakimi, M., Shahidzay, A. K., Fazi, A. W., & Qarizada, A. (2024). Empirical Assessment of ICT Impact on Teaching and Learning in High Schools: A Study in the Context of Balkh, Afghanistan. *EIKI Journal of Effective Teaching Methods*, 2(1).
- Hakimi, S., Ziayee, A., & Ahmadzai, M. (2024). The Role of ICT Resources in Enhancing Student Academic Performance and Quality of Graduates: A Case Study of Balkh High Schools. *Journal of Education and Development*, 8(1), 23–35. <https://doi.org/10.5281/pzen.75892>
- Iancu, A. (2023). The Role of Information and Communication Technologies (ICT) in Early Childhood Education. Integrating Educational Software into Activity. *Moldavian Journal for Education and Social Psychology*, 7(1), 1-8.
- Innovative Technology Experiences for Students and Teachers (ITEST). (2022). *NSF - National Science Foundation*. <https://new.nsf.gov/funding/opportunities/itest-innovative-technology-experiences-students-teachers/nsf22-585/solicitation>
- Jayalakshmi, S. (2024). Perspective of ICT Tools in Education - ICT Tools in Modern Business. In R. Jeyanthi, & S. Dhivya (Eds.), *Recent Research Trends in Commerce, Management & Information Technology*. *Shanlax International Journal of Commerce*.
- Kihoza, P., Zlotnikova, I., Bada, J., & Kalegele, K. (2016). Classroom ICT integration in Tanzania: Opportunities and challenges from the perspectives of TPACK and SAMR models. *International Journal of Education and Development using ICT*, 12(1).
- Kilag, O. C., Castillon, V. N., & Diaz, L. V. (2024). Integrating Lifelong Learning Competence in the Teacher Education Curriculum: Perspectives and Practices of Teacher Educators. In A. P. Alcantara, & L. C. Dacanay (Eds.), *Proceedings of the 6th Biennial National Conference on Research in Teacher Education*. Philippine Normal University Press.
- Laabidi, Y. (2024). Enhancing Teaching through ICT Integration: Insights from Moroccan University English Language Professors. *TESOL and Technology Studies*, 5(1), 7-19.

- Mathura, R., & Muslim, S. (2024). *MulSemedia in Special Education: A Novel Teaching Approach for the Next Generation*. CRC Press.
- Mena, J., Singh, B., & Clarke, A. (2020, October). *New challenges for teacher education introduced by the use of ICT in the classrooms*. In Eighth International Conference on Technological Ecosystems for Enhancing Multiculturality (pp. 859-861).
- Ngao, A. I., Sang, G., & Kihwele, J. E. (2022). Understanding teacher educators' perceptions and practices about ICT integration in teacher education program. *Education Sciences*, 12(8), 549.
- Ngao, D. N. L., Nguyen, T. T. T., Nguyen, T. H., Pham, P. T., & Vu, T. (2022). Teacher Educators Integrating ICT in Vietnam: Perceptions, Practices, and Interplay. *Sustainability*, 14(19), 12353.
- Ngaya, N. M., Omae, H., & Thurania, M. (2024). Evaluation of Teacher Training in Integration of ICT in Teaching Public Secondary Schools in Tigania West, Meru County, Kenya. *International Journal of Research and Innovation in Social Science*, 8(9), 379-386.
- Oluwagbemileke, F. B. (2024). Narrative Review of Information and Communication Technology (Ict) Integration In Nigerian Secondary Schools'home Economics Instruction. *Nigeria Journal of Home Economics (ISSN: 2782-8131)*, 12(10), 144-151.
- Oluwagbemileke, O. J. (2024). Prospects and Challenges of Integrating ICTs into Home Economics Education in Nigeria. In D. O. Durowoju, & S. A. Ogunyemi (Eds.), *Home Economics for Sustainable Development*. University of Ibadan Press.
- Omariba, A. (2020). *Perspectives of Teacher Trainees' Preparedness and Adoption on Integration of ICT in Public Teacher Training Colleges in Kenya*.
- Pandita, D., & Kiran, R. (2023). Digital Literacy as a Mediator of Technology Integration Practices and Student Academic Performance: A Multilevel Mediation Analysis of Higher Secondary Schools. *Education and Information Technologies*.
- Rafiq-uz-Zaman, M., & Nadeem, M. A. (2024). Comparative Analysis of Skill-Based Education Curriculum in Pakistan and India: A Contemporary Review. *International Journal of Academic Research for Humanities*, 4(3), 188-197.
- Rafiq-uz-Zaman, M., Nadeem, M. A., & Rasheed, I. (2024). Empowering Women through Skill-Based Education in Pakistan: A Narrative Review. *Global Sociological Review*, 9(4), 52-59. [https://doi.org/10.31703/gsr.2024\(IX-IV\).05](https://doi.org/10.31703/gsr.2024(IX-IV).05)
- Robertson, J., & Al-Zahrani, A. M. (2012). The Nature of ICT Integration in Saudi Arabia: The Pre-service Teachers' Perspective. *Journal of Information Technology Education: Research*, 11, 181-196. <https://doi.org/10.1515/jite.2012.181>
- Robertson, M., & Al-Zahrani, A. (2012). Self-efficacy and ICT integration into initial teacher education in Saudi Arabia: Matching policy with practice. *Australasian Journal of Educational Technology*, 28(7).
- Seenivasan, R. (2024). ICT in Education: A Critical Literature Review and Its Implications. *International Journal of Finance, Insurance and Risk Management*, 14(1), 12-27.
- Taheri, R., Zandi, N., & Mousavi, V. (2024). Empowering Educators: The Critical Role of Teacher Education Programs in Advancing Digital Literacy Skills. *Library Progress (International)*, 44(3), 10064-10068.

- Timotheou, C., Louca, L., Charalambous, K., & Hadjithoma, C. (2022). Examining the impact of digital technologies on education and factors affecting schools' digital capacity and transformation: A non-systematic literature review. *Education Sciences*, 12(9), 959.
- Timotheou, S., Miliou, O., Dimitriadis, Y., Sobrino, S. V., Giannoutsou, N., Cachia, R., Monés, A. M., & Ioannou, A. (2022). Impacts of digital technologies on education and factors influencing schools' digital capacity and transformation: A literature review. *Education and Information Technologies*, 28(6), 6695–6726. <https://doi.org/10.1007/s10639-022-11431-8>
- Tomaro, Q. P. V. (2018). ICT integration in the educational system of Philippines. *Journal of Governance and Public Policy*, 5(3), 259-282.
- Tondeur, J. (2018, October). Enhancing future teachers' competencies for technology integration in education: Turning theory into practice. *In Seminar. Net*, 14(2), pp. 216-224).
- Vieira, A. P. R., & Pedro, L. (2023). Exploring the Levels of Digital Competence of Future Teachers: A Study at the University of Aveiro. *European Journal of Education Studies*, 9(10), 191–212.
- Voogt, J., & Tondeur, J. (2015). Guest editorial: Teacher learning in the age of the network. *Technology, Pedagogy, and Education*, 24(4), 417–424.
- Wang, Z., De Jong, T., & Van Der Meij, J. (2022). Mobile technology use for teaching and learning: A systematic review. *Computers & Education*, 199, 104446.
- Voogt, J., & Tondeur, J. (2015). Towards design-based approaches for ICT integration in African education. *Technology, Pedagogy and Education*, 24(5), 527-535.
- Vyalikova, G., Plekhanova, M., Pluzhnikova, J., & Savelyeva, S. (2019). General pedagogical ICT competency as a content-forming factor in the training of a new teacher. *ARPHA Proceedings*, 1, 989-1001.
- Wang, J., Tigelaar, D. E., & Admiraal, W. (2022). From policy to practice: Integrating ICT in Chinese rural schools. *Technology, Pedagogy and Education*, 31(4), 509-524.
- Zhao, R., Lei, J., & Tan, C. (2023). Teacher Education 2.0: Innovating China's Teacher Education System in the Digital Era. *International Journal of Educational Development*, 114, 104420.