



Role Of Information And Communication Technology In Academic Achievement Among Prospective Teachers: A Thematic Review

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Abstract: Information and Communication Technology (ICT) has become an essential component of teacher education and it has significantly contributed to academic achievement of prospective teachers. This study aims to identify the major themes related to ICT and academic achievement among prospective teachers through a thematic review. Relevant research articles published between 2009 and 2025, were systematically reviewed for this study. Five major themes were found after the analysis namely; (i) Academic achievement, (ii) Digital Competence, (iii) Collaborative Learning, (iv) Institutional Support, and (v) Challenges for ICT Integration. The findings of the study indicate that effective ICT integration enhances learning outcomes, digital competence, motivation and collaborative learning among prospective teachers. However, the effective use of ICT in teacher education was found to be hampered by challenges like; inadequate infrastructure, limited digital skills and insufficient professional training. The review concludes that strengthening ICT competencies, institutional support and technology-enabled pedagogical practices is vital for improving the academic achievement of prospective teachers.

Keywords: Information and Communication Technology, ICT, Academic Achievement, Prospective Teachers, Teacher Education, Digital Competence, Thematic Review.

I. INTRODUCTION

Information and Communication Technology (ICT) has become an integral component of 21st-century education; transforming traditional teaching and learning into more interactive and learner-centred experiences (Lin et al., 2017; Chen et al., 2018; Gnambs, 2021; Molla & Seyoum, 2022). The integration of ICT enhances students' engagement, critical thinking, problem-solving abilities and academic performance (Planinc & Kolnik, 2016; Akram et al., 2021a; Jomezai et al., 2021; Liu et al., 2022; Baytar et al., 2023; Toma et al., 2023). ICT competence is particularly important as they are expected to integrate digital technologies effectively into future classroom practices for prospective teachers (Tondeur et al., 2017; Watson & Rockinson-Szapkiw, 2021; Istiningsih, 2022). However, despite the growing emphasis on ICT integration; challenges like inadequate technological skills, limited infrastructure, insufficient professional training and restricted access to digital resources continue to hinder its effective implementation in teacher education (Asad et al., 2020; Abbasi et al., 2021; Dzinoreva & Mavunga, 2022; Akram et al., 2022; Msambwa et al., 2024).

Although numerous studies have examined ICT integration in education, existing evidence remains fragmented; particularly concerning the relationship of ICT with the academic achievement of prospective teachers. Therefore, a thematic review is essential to synthesize the existing literature to identify the emerging themes and provide a comprehensive understanding of how ICT contributes to the academic achievement of prospective teachers.

II. OBJECTIVE OF THE STUDY

To identify the major themes related to ICT and academic achievement among prospective teachers.

III. REVIEW METHODOLOGY

(i) Search Strategy

To examine the relationship between Information and Communication Technology (ICT) and the academic achievement of prospective teachers, this study adopted a thematic literature review approach. Relevant literature was identified through a systematic search on Google Scholar. The combinations of keywords such as "Information and Communication Technology," "ICT integration," "teacher education," "prospective teachers," "academic achievement" and "digital learning". To conduct the search for this study, only studies published between 2015 and 2025 were considered.

(ii) Inclusion and Exclusion Criteria

Predetermined inclusion and exclusion criteria were developed to ensure the relevance and quality of the reviewed literature as mentioned below.

Inclusion Criteria

- ✓ Peer-reviewed journal articles.
- ✓ Studies published in English between 2015 and 2025.
- ✓ Studies focusing on ICT integration in education.
- ✓ Studies examining ICT in relation to academic achievement, learning outcomes or teacher education.
- ✓ Studies involving prospective teachers and teachers.

Exclusion Criteria

- ✓ Conference papers, book chapters, dissertations and reports.
- ✓ Studies published in languages other than English.
- ✓ Studies published before 2015.
- ✓ Studies unrelated to ICT in education or academic achievement.

The selected papers were thoroughly studied and analysed following the above the screening process.

IV. THEMATIC FINDINGS

i. Academic Achievement

ICT enhances teaching and learning by promoting interactive and collaborative learning environments that improve students' engagement, critical thinking and academic performance (Akram et al., 2022; Mohd et al., 2024; Msambwa et al., 2024). The integration of digital platforms, learning management systems, cloud computing, multimedia resources and online communication tools enables learners to access diverse educational materials and develop higher-order thinking skills; improving their learning outcomes (Sabiri, 2020; Ghulhane, 2013; Li, 2025). Studies further indicate that ICT strengthens prospective teachers' digital competence and readiness to integrate technology into future classrooms (Enochsson & Rizza, 2009; Kaminskienė et al., 2022). Furthermore, ICT facilitates continuous communication between teachers and learners and supports flexible and self-directed learning; contributing positively to academic achievement (Akram et al., 2022; Sabiri, 2020; Msambwa et al., 2024). However, the literature also emphasizes that these

educational benefits depend on effective pedagogical integration and teachers' technological competence which suggests that ICT serves as a catalyst for academic achievement only when accompanied by appropriate training and infrastructure (Bingimlas, 2009; Mohd et al., 2024; Li, 2025; Akram et al., 2022).

ii. Digital Competency

The studies consistently emphasize that effective use of ICT depends largely on prospective teachers' technological knowledge, digital literacy and positive attitudes towards technology integration (Li, 2025; Akram et al., 2022; Mohd et al., 2024). Teacher education institutions play a crucial role in equipping future teachers with the necessary ICT competencies to meet the demands of twenty-first century classrooms; improving both their academic performance and professional preparedness (Ghulhane, 2013; Sabiri, 2020). The review further reveal that continuous ICT training and technology-rich learning environments significantly improve prospective teachers' confidence to integrate ICT into teaching practices (Msambwa et al., 2024; Akram et al., 2022). Li (2025) found that ICT beliefs, technology competence is among the most frequently investigated themes in pre-service teacher education. This highlights their importance in shaping future instructional practices. Likewise, several studies reported that teachers with higher levels of digital competence demonstrate greater innovation and learner engagement; contributing to improved academic achievement (Kaminskienė et al., 2022; Hafifah, 2020). Nevertheless, inadequate ICT skills and low technological confidence continue to hinder effective ICT integration among prospective teachers which shows there is a need for comprehensive professional development programmes within teacher education institutions (Bingimlas, 2009; Mohd et al., 2024; Msambwa et al., 2024; Sabiri, 2020).

iii. Collaborative Learning

ICT-supported teaching encourages prospective teachers to engage in interactive learning through digital platforms and collaborative applications which makes learning more flexible and learner-centred (Akram et al., 2022; Mohd et al., 2024). The use of digital technologies increases learners' motivation and participation. This allows them to access educational resources anytime and collaborate effectively with peers and instructors (Msambwa et al., 2024; Sabiri, 2020). Similarly, Li (2025) reported that positive beliefs towards ICT encourage pre-service teachers to adopt innovative teaching practices and participate more actively in technology-enhanced learning. Ghulhane (2013) further noted that ICT creates an interactive learning environment; enhancing critical thinking and creative thinking among teacher trainees. Collectively, the review suggests that ICT not only improves academic achievement by increasing learner engagement and collaboration but also prepares prospective teachers to adopt student-centred instructional approaches in their future classrooms.

iv. Institutional Support

Effective ICT integration requires access to digital devices, technical assistance and supportive institutional policies (Akram et al., 2022; Mohd et al., 2024). Studies also emphasize that teacher education institutions should provide continuous ICT training and sufficient technological resources to strengthen prospective teachers' digital competence (Msambwa et al., 2024; Li, 2025). Furthermore, inadequate infrastructure and lack of technical support remain major barriers that restrict effective technology integration (Sabiri, 2020; Bingimlas, 2009; Nagi et al., 2025). Therefore, creating a supportive institutional environment is fundamental to ensure that the prospective teachers can effectively utilize ICT to enhance their academic learning.

v. Challenges for ICT Integration

Common barriers include inadequate ICT infrastructure, limited digital competence, insufficient professional training, lack of technical support and resistance to adopting technology-enhanced teaching practices (Akram et al., 2022; Mohd et al., 2024; Msambwa et al., 2024). Studies also emphasize the need for continuous professional development, curriculum reforms and increased institutional investment to strengthen ICT integration in teacher education (Li, 2025; Sabiri, 2020). Addressing these challenges will not only improve the academic achievement of prospective teachers, but also enhance the readiness of teachers to integrate ICT effectively in future classrooms (Ghulhane, 2013).

V. DISCUSSION

The present thematic review reveals that ICT plays a vital role in improving the academic achievement of prospective teachers by promoting learner-centred teaching and increasing student engagement. The review also reveals that the successful integration of ICT depends on adequate institutional support and ICT infrastructure. Despite these benefits, challenges such as inadequate digital skills and insufficient training continue to hinder the effective integration of ICT in teacher education (Akram et al., 2022; Mohd et al., 2024; Msambwa et al., 2024; Li, 2025; Nagi et al., 2026).

VI. Future Research Directions

Future studies should focus on empirical investigations to examine the relationship between ICT and academic achievement among prospective teachers. More research is also required on emerging technologies such as artificial intelligence and learning analytics in teacher education. Additionally, area-specific studies in regions like Nagaland which are underexplored would provide more insights into the opportunities and challenges of ICT integration in enhancing prospective teachers' academic achievement.

VII. Conclusion

This study concludes that ICT has become an important component of teacher education and the academic achievement of prospective teachers. Developing ICT competence and providing continuous professional training are essential for maximizing the educational benefits of technology. Future research should focus on empirical investigations in regional contexts such as Nagaland which would generate context-specific evidence for strengthening ICT integration in teacher education.

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