

Educators' Access to and Implementation of AI-Related Professional Development: Challenges and Barriers: A Systematic Literature Review

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INTRODUCTION & AIM

Artificial Intelligence (AI) is rapidly transforming education, influencing how knowledge is created, accessed, and taught. From adaptive learning systems to generative AI applications, these technologies offer significant opportunities to personalise learning, enhance assessment practices, and support student engagement. However, their growing use also raises important ethical, pedagogical, and practical concerns, including issues related to bias, transparency, data privacy, and educational equity.

As schools increasingly adopt AI technologies, educators are expected to develop new forms of digital competence and pedagogical expertise. Yet many teachers face challenges in accessing relevant professional development and support. This study aims to examine the barriers and challenges associated with educators' access to and implementation of AI-related professional development. Through a systematic literature review, the study explores educators' perceptions of AI integration, existing professional development approaches, and the role of school leadership in fostering effective and ethical AI adoption in educational settings.

Research Questions

- What challenges do educators face in accessing and implementing AI?
- What AI-related professional development opportunities currently exist?
- How do teachers perceive the integration of AI into teaching and learning?

METHOD

Research Design

A systematic literature review was conducted to examine professional development approaches that support educators in integrating Artificial Intelligence (AI) into teaching and learning. The review followed the PRISMA 2020 guidelines to ensure transparency, rigour, and replicability (Figure 1). Specifically, the study followed a two-phase design. In the first phase, a systematic literature review was conducted following the PRISMA 2020 guidelines (Page et al., 2021). In the second phase, a thematic analysis (Braun & Clarke, 2006) was performed using NVivo to identify recurring patterns and themes related to AI literacy, professional development, pedagogical integration, leadership support, and implementation barriers. An inductive coding approach was adopted, supported by AI-assisted analysis to identify recurring concepts and generate preliminary codes, while all themes were subsequently reviewed, refined, and interpreted.

Data Sources

- Scopus
- Web of Science (WoS)
- ERIC

Search Terms

- Artificial Intelligence (AI)
- AI Literacy
- Digital Competence
- Professional Development
- Teacher Training
- Education

Eligibility Criteria

- Were peer-reviewed empirical studies;
- Focused on teacher professional development and training;
- Examined AI or digital technologies in education;
- Were published in English;
- Were published within the last five years.

Data Analysis

A thematic synthesis approach was employed to identify recurring patterns and themes related to:

- AI Challenges and Barriers
- AI literacy
- Professional development models
- Digital competence
- Leadership support

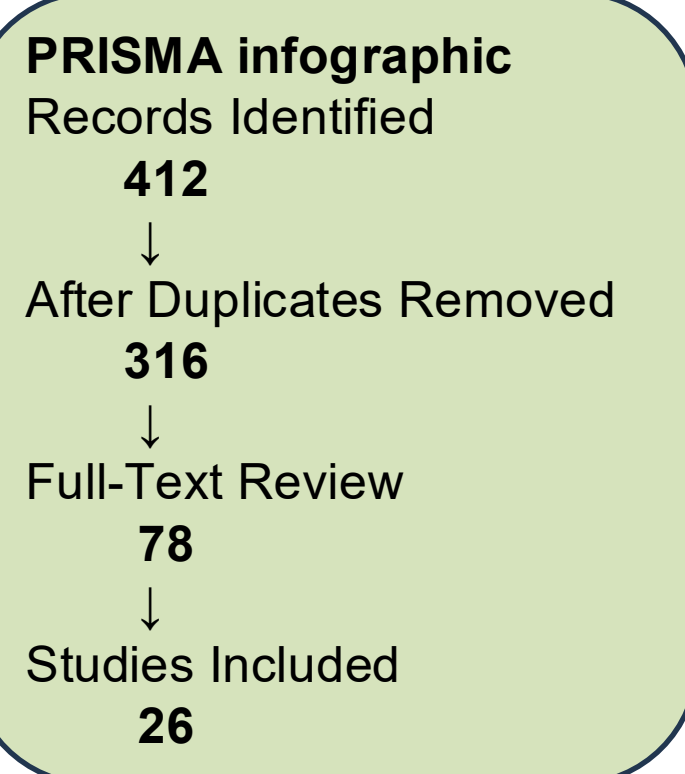


Figure 1. Study Selection

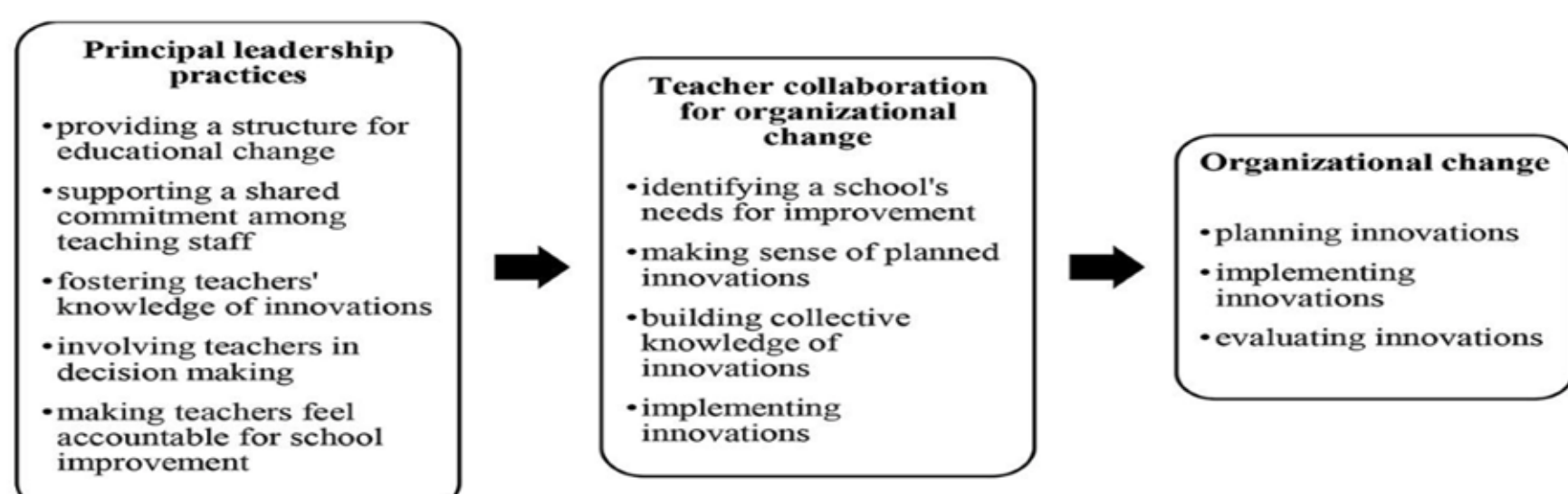


Figure 2. Leading Innovation in AI-Enhanced Education

RESULTS & DISCUSSION

Regarding RQ1, the review identified both opportunities and challenges associated with AI integration. AI was found to support personalized learning, adaptive instruction, formative assessment, instructional planning, and professional growth, while barriers included limited AI literacy, lack of confidence, ethical concerns, workload pressures, and insufficient institutional support (Tammets & Ley, 2023; Meishar-Tal et al., 2025; Dilek et al., 2025). Regarding RQ2, the findings revealed that AI-related professional development opportunities are expanding through case-based learning, experiential approaches, MOOCs, micro-credentials, and self-directed learning (Figure 2). Figure 2 illustrates how supportive school leadership can foster teacher collaboration, which in turn facilitates the planning, implementation, and evaluation of educational innovations (Ding et al., 2024). However, effective programs were characterized by sustained engagement, collaboration, reflective practice, and the development of trust, AI literacy, and ethical awareness (Nazaretsky et al., 2022; Ding et al., 2024; Tammets & Ley, 2023). Regarding RQ3, educators generally perceived AI as a supportive pedagogical partner rather than a replacement for professional expertise, emphasizing the importance of teacher confidence, agency, critical AI literacy, and human oversight for meaningful classroom implementation (Li et al., 2025; Meishar-Tal et al., 2025; Tammets & Ley, 2023). Across all studies, four main themes emerged (Table 1): AI readiness, professional development, pedagogical integration of AI, critical AI literacy, Educator agency. These findings suggest that successful AI integration is a systemic and systematic educational change process requiring alignment between professional learning, leadership, ethical frameworks, and classroom practice.

Parent Themes and Subthemes
Theme 1: AI Readiness
Theme 1.1: Teacher Capacity, Confidence, and AI Literacy
Theme 1.2: Professional Development and Continuous Learning
Theme 2: Pedagogical Integration of AI
Theme 2.1: AI as a Supportive Professional Partner
Theme 3: Critical AI Literacy
Theme 3.1: Ethical and Societal Challenges
Theme 4: Educator Agency
Theme 4.1: Teacher Agency through Co-Design and Collaboration
Theme 4.2: Tensions, Challenges, and Conditions for Adoption

Table 1. Theme Hierarchy

CONCLUSION

This systematic literature review found that Artificial Intelligence (AI) has significant potential to enhance teaching, learning, assessment, and professional development. However, effective AI integration depends not only on technological advances but also on educators' AI literacy, confidence, pedagogical competence, and access to sustained professional development and institutional support. The findings suggest that AI is most effective when it complements rather than replaces teachers' expertise and when its adoption is supported through collaborative leadership, continuous learning, and clear educational policies.

FUTURE WORK / REFERENCES

Future Research Directions

- Professional Development and Teacher Capacity
- Educational Systems and Leadership
- Ethical, Equitable, and Pedagogical AI Integration

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