

Teachers' Digital Competence and Continuous Professional Development in the Age of Digitalization

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Abstract - The life of a teacher and teaching has been changing rapidly with the excessive use of modern technology and digital tools. Despite in-depth research on digital competence frameworks and teacher professional development as distinct areas, a detailed conceptual framework that directly links these two fields remains unexplored. This paper argues that digital competence is not merely a technical skill. It is an evolving professional ability. To stay effective, autonomous, and critically reflective in AI-enhanced education, teachers need to develop it through ongoing professional development programs. Exploring secondary sources and policy documents spanning 2015 to 2025, this paper identifies three key issues in the current literature such as, inconsistent definitions of digital competence across frameworks; mismatch between existing professional development models and new AI requirements; and ongoing uncertainty about teacher agency in AI-integrated settings. As a result, this paper proposes a conceptual framework, the Adaptive Digital Professionalism (ADP) model that shows digital competence as a context-sensitive and critically informed dimension of teacher professionalism. The paper concludes by outlining implications for institutional policy, curriculum design for teacher education, and future empirical research directions.

Key Words: Digital competence, Continuous Professional Development, Teacher professionalism, Adaptive professional learning

1. INTRODUCTION

The twenty-first century has posed greater challenges to the teaching profession with the rapid adoption of digital technologies and artificial intelligence across every dimension of educational practice. Contemporary classroom environments are changing radically because of the increased role of AI in every aspect of teaching and learning. This requires the techno-friendly teachers familiar with digital tools with critical understanding of their applications, ethical implications, limitations, and potential consequences. These necessities require digital competence which has emerged as a central focus of educational policy and discourse. As a result, many frameworks are being developed by institutions like the European Commission, United Nations Educational, Scientific and Cultural Organisation (UNESCO), and other national governments. The prominent institutions like European Digital Competence Framework for Educators (DigCompEdu) and UNESCO's ICT Competency Framework for Teachers (ICT CFT) are attempting to assess, define and guide the development of teacher technical competence.

The relationship between digital competence and continuous professional development (CPD) is particularly unexplored. Most of the literature treats CPD as a means of delivering digital skills to teachers rather than as a transformative professional process that fosters adaptive, reflective, and critical competencies. This narrow perspective has important implications, as it portrays teachers as passive recipients of technological training rather than as active professionals who interpret, adapt, and shape the use of technology in their teaching practice. This article is based on the following research objectives

- To examine existing digital competence frameworks and professional development models, which are inadequate for preparing teachers to work effectively in technology-integrated educational settings.
- To explore the Adaptive Digital Professionalism (ADP) model as a conceptual framework that conceptualises digital competence as a dynamic professional competence.
- To discuss the ADP model into working implications for educational policy and institutional leadership to support the development of teacher digital competence.

2. LITERATURE REVIEW

Foundational frameworks such as the European Digital Competence Framework for Educators (DigCompEdu) and the UNESCO ICT Competency Framework for Teachers have attempted to standardise these expectations, yet as Synergy (2025) observes there are significant differences persist across major frameworks, particularly in how they conceptualise collaboration, ethical dimensions, and professional development reflecting what Heine et al. (2023) describe as a field-wide definitional inconsistency, whereas the term "digital competence" is used in fundamentally different ways across studies. Systematic literature reviews show a significant growth in teacher digital competence research from 2017 onward (Basilotta-Gómez-Pablos et al., 2022), corresponding with the publication of DigCompEdu. The majority of higher education studies rely on academic literature and EU policy documents (Zhao et al. 2021). However, this creates a general agreement at the surface level but hides important differences in the key concepts. Smestad et al. (2023) identified an issue that appears repeatedly across multiple studies is the field's over-reliance on self-report instruments. They found this issue in studies conducted both before and during the COVID-19 period. They noted that these instruments mainly capture teachers' perceptions of their own abilities rather than their actual performance in classroom settings. A bibliometric analysis

conducted by Ma and Ismail (2025) reveals another important issue in digital competence research. Most studies are concentrated in a few countries. Spain is found to be the leading contributor in this research area. This concentration raises the question about the generalizability of findings around the world. The arrival of artificial intelligence as a mainstream educational tool has deepened these challenges considerably. Mikeladze et al. (2024) classify existing AI competence frameworks into two categories: Technological Pedagogical Content Knowledge (TPACK) frameworks and the frameworks treating AI literacy as an entirely new professional domain. According to Lucas et al. (2024) teachers' knowledge of AI plays an important role in shaping their trust in AI more robustly than general digital competence scores alone. These findings challenge skill-transmission models of professional development. On the professional development side, Gallego Joya et al. (2025) found in their systematic review that targeted training programmes help improve teachers' motivation and skill especially in areas such as information literacy and content creation. However they also noted that many of these programmes do not fully match actual needs of teachers and educational settings. This observation resonates with Anis's (2024) argument that the COVID-19 pandemic did not create structural gaps in teacher digital readiness but rather exposed inadequacies that had long existed beneath the surface of pre-pandemic institutional arrangements. Cukurova et al. (2024) argues that education systems are struggling to keep pace with rapid AI developments. They argue that teachers need not only technical training but also the ability to use AI critically, make informed decisions, and apply it appropriately in different teaching contexts. According to Simuț et al. (2024), there is a significant positive relationship between teachers' attitudes toward AI and the development of professional competencies, particularly in educational management. This suggests that professional development should focus not only on skills and knowledge but also on teachers' attitudes. Taken together, this body of literature reveals a field that is rich in frameworks and empirical data but characterised by definitional fragmentation, methodological limitations, structural geographic imbalances, and a persistent failure to bridge the gap between technical skills training and the kind of critically reflexive, adaptive, and institutionally supported professional development that the AI era genuinely demands a gap that the Adaptive Digital Professionalism model proposed in this paper directly seeks to address.

3. THE DIGITAL COMPETENCE LANDSCAPE

3.1 The Definitional Challenge

Teacher digital competence has a huge definitional dissimilarity across studies, some systematic review of digital competence research in higher education between 2015 and 2021 found that the majority of studies rely on both academic literature and European Union policy documents while defining teacher digital competence (Zhao et al. 2021). Yet, this agreement covers considerable variation in conceptual emphasis and theoretical grounding. Similarly, some articles

identify significant differences across major frameworks, particularly in how they conceptualise ethical dimensions, collaboration, and professional development of teachers, despite surface-level agreement on foundational components such as collaboration, information literacy, communication, and content creation (Synergy (2025).

The definitional challenges extend to some dynamic elements of the construct. In a systematic review of the term 'digital resources' as it appears in teacher professional digital competence research (Heine et al. 2023), found that the concept is used inconsistently across the field, with some studies treating it as a broad category inclusive of hardware and software and others restricting it to software-based tools alone. Critically, most existing definitions are characterised as 'basic' examples rather than offering theoretically grounded frameworks. This definitional ambiguity is not merely a semantic inconvenience; it creates ground-level consequences for the design of professional development programmes, assessment instruments, and policy interventions. Some studies contribute an important historical dimension to this analysis by exploring that research on teacher digital competence in higher education grew rapidly, coinciding with the publication and dissemination of DigCompEdu (Basilotta-Gómez-Pablos et al. 2022). This temporal correlation suggests that the framework's publication actively shaped the research agenda, introducing a degree of conceptual standardisation while simultaneously constraining the field's theoretical imagination.

3.2 Framework Diversity and Its Implications

The addition of AI competence frameworks is making the conceptual understanding of digital competency more complex. Mikeladze et al. (2024) classify existing AI competence frameworks into two categories: Technological Pedagogical Content Knowledge (TPACK) frameworks and the frameworks treating AI literacy as an entirely new professional domain. This classification has significant implications for professional development design. Institutions must make explicit choices about whether they are extending or reinventing the foundations of teacher digital competence. The analysis of digital competence frameworks offered by Synergy (2025) adds an important policy dimension. It says national regulatory environments increasingly specify that future teachers must be capable of incorporating digital tools across both instructional and administrative functions. This dual expectation covering both pedagogical and operational dimensions of the profession reflects the comprehensive scope that contemporary digital competence demands. Hence, it raises the question of whether current professional development programmes are equipped to address this demand. Ma and Ismail (2025) in their bibliometric analysis of digital competence in education identify a rise in digital competence research with Spain emerging as the most productive and cited country. This geographic concentration raises questions about the transferability of findings across diverse educational cultures, governance structures, and technological infrastructure contexts. The majority of frameworks and empirical studies reviewed in this paper originate from European and North American contexts. This becomes a limitation that must be taken into consideration for any global application of their prescriptions.

3.3 Self-Report Bias and the Knowledge-Trust

A key methodological concern in the digital competence literature is the over-reliance on self-reported data. Smestad et al. (2023), in their systematic reviews ranging from pre-Covid to during-COVID periods, observe the predominance of self-report measures in digital competence research. This produces

data that reflect teacher perceptions of their own ability rather than empirically observed classroom performance. This methodological limitation is particularly consequential when self-assessments are used to design professional development curricula. Teachers may overestimate or underestimate their competence. The programmes prepared from these data may not meet the actual developmental needs.

Digital competence and AI literacy has another empirical complexity. Lucas et al. (2024) demonstrate that while higher digital competence is positively associated with greater knowledge of AI. Trust plays an important role in this relationship. In particular teachers' knowledge of AI predicts their trust in AI more strongly than their digital competence when both variables are considered together. This finding has important implications for CPD design. It suggests that professional development programmes that focus exclusively on broadening digital skills without specifically addressing AI knowledge may fail to foster the trust and productive uncertainty that teachers need to critically evaluate AI-generated content and recommendations in their practice.

4. CONTINUOUS PROFESSIONAL DEVELOPMENT(CPD)

4.1 CPD as a Response to Digital Disruption

The COVID-19 pandemic catalysed the digital transformation. This has reshaped teacher professional development globally. Anis (2024) argues that the pandemic forced digitisation of schooling and exposed pre-existing structural gaps in CPD provision. These were always present but had been hidden by the relative stability of pre-pandemic institutional arrangements. After COVID, CPD (Continuous Professional Development) became a critical need for educational institutions. The rapid development of technology makes it difficult for initial teacher education programmes to prepare graduates for all the classroom challenges they will face during their careers.

However, the response of institutions to this need has not been uniform. Gallego Joya et al. (2025), in their systematic review of training programmes for teacher digital competence found a common pattern in the literature. Targeted training programmes improve teachers' motivation and competence, particularly in the areas of information literacy and digital content creation. There is a clear gap between the programme design and actual educational needs. Many programmes focus on technologies that were useful in the past instead of preparing teachers for continuous technological change. These programmes often fail to develop the adaptive skills needed to respond to new technologies. European institution, say that education systems are finding it hard to keep pace with rapid AI developments. These developments have raised important concerns about assessment integrity, academic honesty, and learning (Cukurova et al. 2024). The report's central recommendation explored that AI's potential in education lies in augmenting human intelligence and supporting complex decision-making rather than automating routine tasks, pointing toward a conception of teacher professional development that is substantively different from skills-transmission models. Developing teachers who can collaborate with AI, critically assess it, and use it effectively requires professional development that is intellectually rigorous and reflective.

4.2 AI as a Driver and Object of Professional Development

A productive conceptual distinction in the literature is between professional development about AI, that is, developing teachers' understanding of what AI is, how it works, and what

its educational implications are, and professional development with AI, in which AI tools are actively deployed to support teachers' own learning and professional growth. Khasanova (2025) finds that AI technologies can enhance CPD quality by automating routine administrative tasks and enabling personalised, adaptive learning experiences that respond to individual teacher developmental trajectories. The capacity of AI to reduce teacher workloads by automating functions such as grading, and resource compilation is notable. However, Khasanova (2025) warns against too much dependence on AI-generated outputs. This reduces the critical reflection which is a core dimension of professional competence. Al-Zyoud (2020), writing when AI was less common in education, argues that AI should help teachers make informed decisions in different teaching situations. It should not replace their professional judgement. Now this view has become more relevant. A clear framework of teacher professional development in the AI era needs separation between AI as a decision-support tool and AI as a decision-making substitute. This suggests the main goal of Continuous Professional Development (CPD) is not to train teachers to simply follow AI recommendations. It is to help them evaluate, modify a and reject those recommendations when their professional judgment considers it necessary. Simuț et al. (2024) finds a significant positive relationship between teachers' positive attitudes toward AI and the development of professional competencies. The study identifies educational management as the domain most strongly influenced by AI attitudes. This suggests that the effects of AI integration on teacher development are not confined to instructional skills but extend to the broader professional and institutional dimensions of the teacher's role. Importantly, the authors conclude that helping teachers develop a positive understanding of AI is just as important as providing technical training. This finding agrees with other studies that emphasize the role of attitudes and beliefs in professional learning.

4.3 Structural Barriers and Institutional Conditions

The studies reviewed in this paper show that several common challenges reduce the effectiveness of CPD in the areas of digital technology and AI. Anis (2024) states that a lack of funding and resistance to change within institutions are major barriers, especially in education systems with limited resources. Pedro et al. (2019), in their UNESCO working paper, view these challenges from a global perspective. They state that preparing teachers for AI-powered environments also requires inclusive data systems and the ethical and transparent use of AI. These findings point to an important idea. The difficulty in helping teachers succeed in the AI era is not mainly due to a lack of motivation or ability among teachers. Instead, it is largely related to how educational institutions are organised and supported. Schools and universities that give teachers enough time, resources, opportunities to work with others, and expert guidance create better conditions for developing digital competence in a lasting and meaningful way.

5. ADAPTIVE DIGITAL PROFESSIONALISM MODEL

5.1 Identifying the Central Tensions

The detailed synthesis of the scholarly literature reveals three major interconnecting tensions that a conceptual framework must address these are followings.

Standardisation vs. Contextualization: The first one is between standardisation and contextualization in existing digital competence frameworks. The major frameworks like

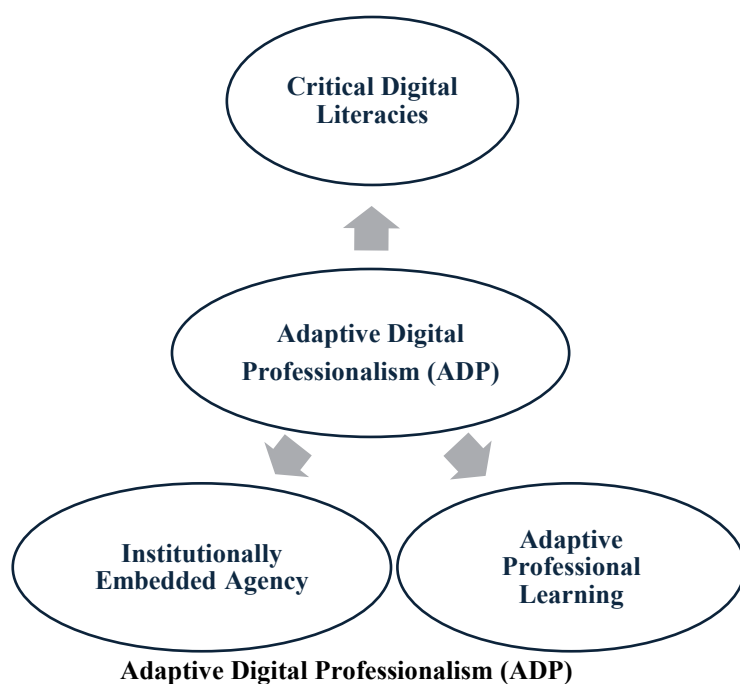
DigCompEdu (European framework for the digital competence of educators), UNESCO ICT CFT (Competency framework for teachers), TPACK (Technological Pedagogical Content Knowledge), and other different AI-based models reflect a desire to provide clear guidance for professional development. However, as study of (Mikeladze et al., 2024 and Synergy., 2025) demonstrate, these frameworks are limited by specific cultural, pedagogical, and technological findings that limit their application ability across different educational contexts. So this conceptual framework has the capacity to address this tension, must be flexible enough to accommodate contextual variation by providing necessary guidance.

Technical Proficiency vs. Critical Reflexivity: The second tension is between the technical proficiency of the teacher and the critical reflexivity of the teacher as defining dimensions of teachers' digital competence. Most CPD provision remains focussed on digital skills related to teaching, used by teachers to operate specific platforms, tools, and applications, while neglecting the epistemological knowledge and ethical dimensions of technology that enable teachers to evaluate, analyse, and selectively utilise technologies in specific pedagogies. Smestad et al. (2023) explored these dimensions in their observation that teachers are often positioned as practitioners implementing technological methods instead of designers of learning environments. This tension requires a reconceptualisation of existing competence that positions critical professional agency alongside digital proficiency.

Teacher Agency vs. AI Dependence: The third and most vital tension concerns about teacher agency in AI-integrated environments and their AI dependency. Some studies suggest that the relationship between digital competence and AI knowledge is more complex than linear skills-acquisition models imply. Teachers who connect with AI systems bring to those interactions a professional self-concept, educational philosophy, and body of contextual knowledge about their students and communities that AI systems cannot access or replicate (Lucas et al., 2024; Khasanova, 2025). There is no concern that AI will make teachers irrelevant, but a concern that for its adaptability, poorly designed professional development systems have a chance to produce teachers who rely on AI outputs rather than critically evaluate the outputs.

5.2 The Adaptive Digital Professionalism (ADP) Model

In response to these tensions, this paper proposes the Adaptive Digital Professionalism (ADP) model to understand and develop digital competence through CPD in the AI era. The ADP model rests on three interconnected dimensions: critical digital literacies, adaptive professional learning, and institutionally embedded agency. Together, these dimensions constitute a reconceptualised understanding of what it means to be a digitally competent teacher in the contemporary educational landscape.



Critical digital literacies (CDL): The first dimension, critical digital literacies, builds technical competence of teachers that highlighted in DigCompEdu frameworks. Beyond the capacity of teacher to use digital tools effectively, critical digital literacies covers the ability to evaluate the epistemological assumptions included in digital and AI systems, to identify the limits and biases of algorithmic outputs, and to make informed consents, to take ethically grounded decisions about when and how to use technology in the service of learning. This dimension directly responds to the tension between technical proficiency of teacher and critical reflexivity and placed this ability as a foundational dimension of professional digital competence.

Adaptive professional learning (APL): The second dimension, APL addresses the structural misalignment between the static competence of teacher and the dynamic character of technological change. This dimension conceptualises continuous professional development (CPD) not as a fixed curriculum of skills but as a continuous, evolving, self-directed, and collaboratively supported process of professional inquiry. Adaptive professional learning (APL) implies that teachers construct metacognitive awareness of their own evolving competence needs, and involved in reflective practice that connects technological experience to educational purpose, with this teacher also participate in professional learning communities that support collective sense-making about technological change (Gallego Joya et al. 2025; Cukurova et al. 2024. & Anis., 2024). The microlearning and social-collaborative strategies identified by Anis (2024) as effective post-COVID CPD modalities are consistent with this dimension, though the ADP model insists that these approaches must be embedded within a reflective professional culture rather than deployed as isolated pedagogical techniques.

Institutionally embedded agency (IEA): The third dimension, institutionally embedded agency, discusses the structural norms and regulations required to make the first two dimensions successful. This dimension insists that teacher digital competence develops with practice and is shaped by the institutional environment (Pedro et al. 2019). A teacher cannot

rely on professional development to empower himself with the new dimensions of AI, rather they require supportive institutions that provide adequate time for professional learning by creating safety atmosphere for experimentation and failure. Institutions should ensure equitable access to technological resources and establish utility structures that protect teachers' professional autonomy in an AI-integrated climate (Pedro et al. 2019; Simuț et al. 2024). Excluding this institutional support, even well-structured continuous professional development (CPD) programmes will fail to transform to meet the demands of the AI era.

5.3 The Dynamics of the ADP Model

A prolific feature of the ADP model is reinforcing teachers to learn new skills. In contrast to existing linear competence development models that treat development as a sequential progression till a teacher becomes an expert, the ADP model describes digital professional competence as a regular feedback cycle process in which each dimension continuously shapes and reshapes as per the demands of the times. Critical engagement of educators with AI systems initiates new learning needs. These learning needs drive self-adaptive professional inquiry to learn new skills. This inquiry produces more critical capacity with strong supportive institutional structures. Similarly, this institutionally supported agency shapes the institutional conditions by contributing to professional culture and by contributing to policy discourse. Moreover, it further contributes to the technology-based governance of educational institutions.

This ADP has key impacts on continuous professional development (CPD) evaluation. Instead of measuring standard skills acquisition against fixed competence benchmarks, the ADP model emphasises that evaluation must attend to the quality of instructors' professional reasoning, their capacity to integrate, justify, and revise their technological choices in relation to educational demands and institutional conditions that enable such reasoning. Gamification method in classroom teaching act as a vehicle for developing digital competence dimensions within the ADP framework (Barroso-Tristán et al. 2025), as one pedagogical strategy for fostering engagement with digital tools and their effectiveness.

6. DISCUSSION

6.1 Implications for Policy and Institutional Practice

The ADP model creates several concrete implications for educational policy and institutional practice that has potential to shape teachers technically. First, it ask for a brief orientation of national and institutional digital competence frameworks away from static skill toward dynamic, reflexive standards that can evolve in response to necessary technological change. Frameworks depended on DigCompEdu provide a valuable starting point, but it require regular revision and contextual adaptation processes to remain meaningful to meet AI advance capabilities. The sharp increase in research outputs signals growing scholarly capacity to inform such revisions, but this capacity can only be mobilised if policy processes are genuinely responsive to emerging research evidence (Ma & Ismail 2025).

Second, the ADP model implies a fundamental redesign of initial teacher education programmes to include significant, critically oriented engagement with AI and digital technologies not as add-on modules but as integrated dimensions of pedagogical, subject-specific, and professional learning. National regulatory frameworks increasingly mandate digital competence for pre-service teachers and the challenges to

ensure that this mandate is fulfilled through transformative educational experiences.

Third, the model underscores the importance of institutional leadership in creating the conditions for sustained professional learning. The observation by Khasanova (2025) that successful AI implementation in education depends on institutional leadership and ethical governance points to a dimension of the challenge that is often absent from teacher-focused CPD discourse. Empowering teachers in the AI era is, in significant measure, a question of institutional culture and governance of whether educational institutions treat teachers as professional partners in navigating technological change or as recipients of top-down technological mandates.

6.2 Limitations of the Conceptual Framework

The Adaptive Digital Professionalism (ADP) model is described primarily from a synthesis of European and North American literature, and its applicability to educational contexts characterised by different governance structures, technological infrastructure, cultural norms, and professional traditions remains an empirical question requiring careful investigation. The over-representation of Spanish and European research contexts in the digital competence literature is a genuine limitation (Ma., & Ismail 2025).

Furthermore, the discussed ADP model is a purely conceptual rather than empirically validated. Its three dimensions that is critical digital literacies (CDL), adaptive professional learning (ADL), and institutionally embedded agency (IEA) are derived from a synthesis of the existing literature and from theoretical reasoning about the demands of the AI era, but these dimensions have not been tested through systematic empirical investigation. The operationalisation of its dimensions, the development of assessment instruments aligned with its principles, and the testing of its claims across diverse educational contexts are the necessary next steps.

7. CONCLUSION

The study concludes that AI is no longer a future idea in education, It is already here, that's reflected in every teacher's daily life, so what we expect from teachers and what professional expertise means. This study shows our field is at a turning point in the field of digital education. We have plenty of frameworks, research findings, and policy advice related to digital technology. But we still struggle with unclear definitions, systems that don't line up, and weak understanding of how digital skills connect to ongoing teacher training.

This article explored that the mentioned tensions cannot be solved solely through the elaboration of small competence frameworks and the expansion of continuous professional development programmes. Rather, what is effective is a conceptual reorientation and a transition from conceiving digital competence as a static representation of skills to be imparted to teachers. At last, to reconceptualise it as a dynamic professional capacity that is cultivated through recursive engagement with critical inquiry, adaptive learning, and institutionally supported agency, the Adaptive Digital Professionalism (ADP) model advanced a conceptual apparatus for this reorientation.

So the CPD of teachers in the digital era ultimately requires strong acknowledgement that teachers are not dependent users of technology, but they are the professional agents who shape the role of technology in the lives of learners. In this context, Digital competence is understood as a threshold to be crossed, but a professional orientation needs to be continuously

cultivated with the help of continuous professional development.

REFERENCES

1. Al-Zyoud, H. M. M. (2020). The role of artificial intelligence in teacher professional development. *Universal Journal of Educational Research*, 8(11B), 6263–6272. <https://doi.org/10.13189/ujer.2020.082344>
2. Anis, M. (2024). Teacher professional development in the digital age: Addressing the evolving needs post-COVID. *International Journal for Multidisciplinary Research (IJFMR)*, 6(1). <https://doi.org/10.36948/ijfmr.2024.v06i01.12975>
3. Author Unknown. (2025). Digital competence in education. *Synergy: International Journal of Multidisciplinary Studies*, 2(1), 9–23.
4. Barroso-Tristán, J. M., García-Lázaro, I., & Reyes-de-Cózar, S. (2025). Gamification in digital environments and the development of teachers' digital competence: A systematic review. *Humanities & Social Sciences Communications*. <https://doi.org/10.1057/s41599-025-04619-x>
5. Basilotta-Gómez-Pablos, V., Matarranz, M., Casado-Aranda, L. A., & Otto, A. (2022). Teachers' digital competencies in higher education: A systematic literature review. *International Journal of Educational Technology in Higher Education*, 19(8). <https://doi.org/10.1186/s41239-021-00312-8>
6. Cukurova, M., Kralj, L., Hertz, B., & Saltidou, E. (2024). Professional development for teachers in the age of AI. *European Schoolnet*.
7. Gallego Joya, L., Merchán Merchán, M. A., & López Barrera, E. A. (2025). Development and strengthening of teachers' digital competence: Systematic review. *Contemporary Educational Technology*, 17(1), ep555. <https://doi.org/10.30935/cedtech/15793>
8. Heine, S., Krepf, M., & König, J. (2023). Digital resources as an aspect of teacher professional digital competence: One term, different definitions – a systematic review. *Education and Information Technologies*, 28, 3711–3738. <https://doi.org/10.1007/s10639-022-11254-5>
9. Khasanova, N. (2025). Empowering educators: How AI tools support continuous professional development. *Mental Enlightenment Scientific-Methodological Journal*, 6(7), 285–293.
10. Lucas, M., et al. (2024). Relation between trust in AI, knowledge of AI and digital competence. *Education and Information Technologies*, 29, 22991–23010. <https://doi.org/10.1007/s10639-024-12638-3>
11. Ma, H., & Ismail, L. (2025). Bibliometric analysis and systematic review of digital competence in education. *Humanities & Social Sciences Communications*. <https://doi.org/10.1057/s41599-025-04537-y>
12. Mikeldadze, T., Meijer, P. C., & Verhoeff, R. P. (2024). A comprehensive exploration of artificial intelligence competence frameworks for educators: A critical review. *European Journal of Education*, 59, e12663. <https://doi.org/10.1111/ejed.12663>
13. Pedro, F., Subosa, M., Rivas, A., & Valverde, P. (2019). Artificial intelligence in education: Challenges and opportunities for sustainable development. *UNESCO Education Sector*.
14. Simuț, R., Simuț, C., Bădulescu, D., & Bădulescu, A. (2024). Artificial intelligence and the modelling of teachers' competencies. *Amfiteatru Economic*, 26(65), 181–200. <https://doi.org/10.24818/EA/2024/65/181>
15. Smestad, B., Hatlevik, O. E., Johannesen, M., & Øgrim, L. (2023). Examining dimensions of teachers' digital competence: A systematic review pre- and during COVID-19. *Heliyon*, 9, e16677. <https://doi.org/10.1016/j.heliyon.2023.e16677>
16. Zhao, Y., Pinto Llorente, A. M., & Sánchez Gómez, M. C. (2021). Digital competence in higher education research: A systematic literature review. *Computers & Education*, 168, 104212. <https://doi.org/10.1016/j.compedu.2021.104212>