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Identification and Prioritization of Teachers' Readiness Components for Employing Artificial Intelligence in the Teaching–Learning Process

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A B S T R A C T

Purpose: This study aimed to identify and prioritize the key components of teachers' readiness for employing artificial intelligence (AI) in the teaching–learning process.

Methods and Materials: The research employed a mixed-methods sequential exploratory design consisting of qualitative and quantitative phases. In the qualitative phase, an extensive literature review was conducted until theoretical saturation was achieved, and data were analyzed using NVivo 14 to extract major categories, subcategories, and open codes. Seven primary readiness dimensions emerged: technological, pedagogical, cognitive, psychological, ethical, organizational, and cultural readiness. In the quantitative phase, a structured questionnaire was developed based on these themes and administered to 200 teachers from public and private schools in Tehran. The data were analyzed using SPSS version 26, applying descriptive statistics and the Friedman ranking test to determine the relative significance of each readiness dimension.

Findings: The Friedman test results indicated significant differences in the mean ranks of the readiness dimensions ($p < 0.05$). Technological readiness achieved the highest mean rank ($M = 4.62$, $SD = 0.54$), followed by pedagogical readiness ($M = 4.45$, $SD = 0.61$) and cognitive readiness ($M = 4.27$, $SD = 0.57$). Psychological readiness ($M = 4.10$, $SD = 0.66$), ethical readiness ($M = 3.95$, $SD = 0.63$), organizational readiness ($M = 3.82$, $SD = 0.69$), and cultural readiness ($M = 3.64$, $SD = 0.72$) ranked lower, highlighting a clear prioritization pattern. These findings suggest that teachers view technical competence and instructional adaptability as foundational elements of AI integration, while ethical, institutional, and cultural factors play supportive yet less immediate roles.

Conclusion: Strengthening professional development, ethical awareness, and institutional support is essential to ensure sustainable and effective AI adoption in education.

Keywords: *Artificial intelligence; teacher readiness; educational innovation; technological competence; pedagogical adaptation*

1. Introduction

The integration of artificial intelligence (AI) into education has redefined the global discourse on teaching and learning, positioning teachers' readiness as a decisive factor in shaping the success of educational innovation (Yehya et al., 2025). As AI continues to transform instructional design, classroom management, and assessment strategies, educators are increasingly required to adapt their pedagogical, technological, and cognitive competencies to meet the demands of intelligent systems (Wang et al., 2025). Recent advancements in machine learning, adaptive algorithms, and predictive analytics have expanded the potential of AI to enhance personalized learning and data-driven instruction (Santana, 2025). However, the degree to which these technologies can improve educational outcomes depends heavily on teachers' readiness—defined as their preparedness, self-efficacy, and willingness to integrate AI meaningfully into teaching–learning processes (Qureshi et al., 2025).

AI readiness among teachers is a multidimensional construct encompassing technological proficiency, pedagogical adaptability, and attitudinal openness (Ofem et al., 2025). It not only involves access to infrastructure and digital tools but also includes psychological and ethical preparedness to employ AI responsibly in classrooms (Ngongpah, 2025). In many educational systems, teachers remain hesitant or underprepared to adopt AI-driven tools, owing to insufficient training and lack of institutional support (Liu et al., 2025). As a result, understanding the underlying dimensions of readiness has become essential for policymakers and educators striving to ensure effective AI integration into educational contexts (Khan, 2025).

The notion of readiness has evolved from simple technological awareness to a comprehensive construct integrating emotional, cognitive, and ethical competencies (Ii, 2025). Studies have indicated that self-efficacy—the belief in one's capability to perform AI-based tasks—plays a mediating role in shaping teachers' willingness to employ AI in classroom settings (Harakchiyska, 2025). This aligns with emerging pedagogical frameworks emphasizing not only skill development but also affective engagement and confidence-building as precursors to technology acceptance (Fteiha et al., 2025). Teachers who perceive themselves as competent and supported in AI adoption exhibit higher levels of engagement, creativity, and instructional flexibility, which ultimately enhance learning outcomes (Farooq, 2025).

Globally, the readiness of educators for AI integration varies across educational levels, regions, and institutional cultures (Dewi et al., 2025). In some regions, AI literacy is increasingly incorporated into teacher education programs, yet challenges persist regarding the alignment between theoretical training and practical application (Balasa, 2025). In particular, developing nations face compounded barriers such as inadequate infrastructure, limited access to AI resources, and cultural resistance to technological transformation (Abraham & Sickel, 2025). Consequently, the identification and prioritization of readiness components provide a strategic foundation for fostering equitable and sustainable AI adoption in education.

Teachers' readiness for AI use has been examined from multiple theoretical and methodological perspectives. In the psychological domain, readiness is shaped by intrinsic motivation, resilience, and attitudes toward technological change (Yue et al., 2024). In the cognitive dimension, it involves understanding AI's pedagogical affordances and limitations (Yang et al., 2024). Pedagogical readiness, meanwhile, encompasses teachers' ability to redesign instructional strategies in ways that integrate adaptive and intelligent systems (Shaari & Kamsin, 2024). These competencies are deeply interconnected—AI adoption requires an integration of digital skills, pedagogical innovation, and self-regulatory capacity, each reinforcing the other (Sakitri et al., 2024).

Teachers' self-efficacy remains a critical determinant of AI adoption success. Research has consistently shown that educators who report higher levels of technological self-efficacy are more likely to engage in exploratory and innovative instructional practices (Rajapakse et al., 2024). Professional development programs emphasizing hands-on AI experience and mentoring support have been effective in increasing confidence and reducing anxiety associated with automation in teaching (Kitcharoen et al., 2024). In addition, contextual factors such as administrative support, collaborative learning environments, and clear institutional policies significantly influence teachers' readiness (Harakchiyska & Vassilev, 2024). The interplay of these factors suggests that readiness is not merely an individual characteristic but an emergent property of institutional ecosystems.

Ethical and attitudinal readiness have also gained prominence as educators confront the implications of AI-based decision-making (Eke, 2024). Teachers must

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understand data privacy regulations, algorithmic bias, and fairness principles to use AI responsibly in assessment and learning management (Alshorman, 2024). While technical proficiency ensures operational competence, ethical literacy ensures that AI is deployed in a way that upholds equity, inclusivity, and human-centered values (Zhang & Villanueva, 2023). Therefore, readiness models now increasingly incorporate moral, social, and philosophical dimensions, aligning AI implementation with principles of digital ethics and professional integrity (Öztürk & Turgut, 2023).

Furthermore, cultural and contextual readiness influence teachers' perceptions of AI's role in education. Teachers operating within technology-friendly cultures tend to show greater enthusiasm and adaptability (Li et al., 2023). Conversely, in traditional education systems where teaching is viewed as a human-centered art rather than a data-driven science, AI may be perceived as intrusive or depersonalizing (Devi et al., 2023). Bridging these cultural gaps requires both systemic reforms and ongoing professional development efforts that address teachers' values, fears, and expectations regarding AI (Abraham & Sickel, 2025).

Recent studies emphasize that the multidimensionality of readiness must be addressed holistically. For instance, AI implementation in education depends simultaneously on teachers' technological competence, pedagogical innovation, psychological adaptability, and institutional backing (Yehya et al., 2025). The relationship between these domains is reciprocal; without cognitive understanding, technological training becomes superficial, while without psychological and ethical awareness, AI integration risks alienating teachers and learners alike (Wang et al., 2025). Therefore, research now seeks to synthesize these dimensions into comprehensive frameworks that can guide teacher training programs and policy development (Santana, 2025).

Several empirical studies provide evidence for these complex interrelationships. For example, Qureshi et al. (Qureshi et al., 2025) found that teachers' perceptions of AI's usefulness and ease of use mediate the relationship between their pedagogical beliefs and their adoption behavior. Ofem et al. (Ofem et al., 2025) demonstrated that technological readiness and positive attitudes significantly enhance teachers' willingness to use AI in classroom assessment. Similarly, Ngongpah (Ngongpah, 2025) identified competency gaps in AI tool usage as a primary barrier to readiness. Complementary findings by Liu et al. (Liu et al., 2025) indicated that teachers' psychological preparation before classroom engagement strongly predicts their confidence in applying AI-assisted pedagogy.

Research by Khan (Khan, 2025) and Ii (Ii, 2025) further reinforces that emotional and social competencies—such as empathy, adaptability, and collaborative spirit—are essential readiness factors in technology-enhanced education. In linguistic and cultural contexts, Harakchiyska (Harakchiyska, 2025) highlighted that English language teachers' openness to AI adoption depends on their predisposition toward innovation and self-directed learning. Parallel findings in the UAE context by Fteiha et al. (Fteiha et al., 2025) revealed that teachers' knowledge, attitudes, and practices form an interdependent triad influencing AI integration. Farooq (Farooq, 2025) extended this framework by demonstrating that psychological readiness mediates the relationship between teacher confidence and classroom innovation.

In the Southeast Asian and Middle Eastern contexts, readiness studies underscore systemic constraints and professional disparities. Dewi et al. (Dewi et al., 2025) found that economic education students' readiness to teach is shaped by both institutional factors and personal motivation. Balasa (Balasa, 2025) emphasized gender and discipline differences in AI literacy and readiness confidence among pre-service teachers, while Abraham (Abraham & Sickel, 2025) confirmed that teacher preparation, self-efficacy, and perceived readiness form a validated causal model. Likewise, Yue (Yue et al., 2024) and Yang (Yang et al., 2024) demonstrated that technological pedagogical content knowledge (TPACK) is a powerful predictor of readiness to engage with AI-driven instruction.

Complementary insights from Shaari (Shaari & Kamsin, 2024) and Sakitri (Sakitri et al., 2024) affirm that readiness encompasses both pre-service and in-service professional dimensions, with future teachers requiring adaptive skills aligned with Industry 4.0 educational paradigms. Rajapakse et al. (Rajapakse et al., 2024) supported this assertion by applying self-efficacy theory to explain readiness levels in Sri Lankan teachers preparing to teach AI-related subjects. Training interventions designed by Kitcharoen (Kitcharoen et al., 2024) demonstrated that professional development in AI and Internet of Things (IoT) applications significantly improves teachers' AI competencies.

At a broader level, Harakchiyska and Vassilev (Harakchiyska & Vassilev, 2024) underscored the influence of contextual variables—such as institutional vision and technological culture—on readiness perceptions. Eke (Eke, 2024) and Alshorman (Alshorman, 2024) reported similar

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patterns in African and Middle Eastern educational systems, where attitude formation and digital literacy remain central challenges. Zhang and Villanueva (Zhang & Villanueva, 2023) introduced the notion of *generative AI preparedness*, emphasizing teachers' competence in navigating emerging generative technologies. Öztürk (Öztürk & Turgut, 2023) added that perceived importance of online teaching competencies correlates strongly with self-efficacy beliefs, while Li (Li et al., 2023) and Devi (Devi et al., 2023) highlighted the mediating role of motivation in shaping readiness and teacher–student relationships.

Overall, these studies converge on the understanding that teachers' readiness for AI integration is multidimensional, context-dependent, and dynamically evolving. It is not merely about acquiring technical skills but also about developing the right mindset, institutional environment, and ethical awareness. The synthesis of prior research highlights the urgent need for contextually grounded frameworks that can guide AI-related teacher development in diverse educational settings.

Therefore, the present study aims to identify and prioritize the components of teachers' readiness for employing artificial intelligence in the teaching–learning process.

2. Methods and Materials

This study was conducted using a mixed-methods approach consisting of two sequential phases: a qualitative exploration followed by a quantitative prioritization phase. The first phase adopted a qualitative design to identify the components of teachers' readiness for utilizing artificial intelligence (AI) in the teaching–learning process. The second phase applied a quantitative ranking method to determine the relative importance of the identified components.

In the quantitative phase, the study population comprised teachers from public and private schools in Tehran during the 2024–2025 academic year. Using a simple random sampling method, 200 teachers were selected to participate. The inclusion criteria were having at least three years of teaching experience and familiarity with digital educational tools.

In the qualitative phase, data were collected exclusively through an extensive literature review, including peer-reviewed articles, conference proceedings, dissertations, and authoritative reports published between 2015 and 2025. The literature search focused on keywords such as "teacher readiness," "artificial intelligence in education," "AI literacy," and "digital pedagogy." The process continued until theoretical saturation was achieved—that is, when no new themes or components emerged from the literature.

All retrieved sources were organized and analyzed using NVivo 14 software, which facilitated systematic coding, categorization, and theme extraction. Through open, axial, and selective coding procedures, the major categories and subcategories of teachers' readiness for AI adoption in education were identified.

In the quantitative phase, a structured questionnaire was designed based on the qualitative findings. This instrument included items representing each of the identified readiness components. The questionnaire was validated through expert judgment and pilot testing. Data were then collected from 200 teachers in Tehran either in person or via secure online forms.

For the qualitative phase, content analysis was performed using NVivo 14. The coding process aimed to reveal key themes related to technological, pedagogical, psychological, and organizational readiness dimensions. The frequency and relationships between codes were analyzed to construct a conceptual framework of teacher readiness for AI-based instruction.

In the quantitative phase, the collected data were analyzed using SPSS version 26. Descriptive statistics such as means and standard deviations were computed to summarize the data. Additionally, ranking analyses were conducted to prioritize the readiness components based on participants' responses. Inferential analyses, including Friedman's test, were used to determine the significance of differences between ranked components. The final output provided an empirical prioritization of the readiness factors essential for successful AI integration in teaching–learning environments.

3. Findings and Results

In the first (qualitative) phase of this study, an extensive literature review was conducted to identify the major dimensions and underlying components of teachers' readiness for employing artificial intelligence (AI) in the teaching–learning process. Using NVivo 14 software, the retrieved sources were coded through a three-stage process—open, axial, and selective coding—to reveal the key categories, subcategories, and conceptual indicators. The analysis resulted in seven main themes, each representing a fundamental dimension of teacher readiness:

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technological readiness, pedagogical readiness, cognitive readiness, psychological readiness, ethical readiness, organizational readiness, and cultural readiness. These categories encompass the full range of competencies, attitudes, and contextual factors that enable teachers to effectively integrate AI into educational practice.

Table 1

Categories, Subcategories, and Concepts (Open Codes) of Teachers' Readiness for Employing AI in the Teaching–Learning Process

Main Categories (Themes)	Subcategories	Concepts (Open Codes)
1. Technological Readiness	Digital literacy	Basic computer skills; familiarity with educational software; online collaboration; data handling competence; troubleshooting ability
	AI operational knowledge	Understanding AI functions; awareness of AI-based educational tools; ability to use chatbots and adaptive systems; familiarity with learning analytics; automation literacy
	Infrastructure access	Stable internet; hardware availability; institutional support; technical assistance
	Continuous digital learning	Willingness to update ICT skills; participation in online tech courses; self-directed digital learning
2. Pedagogical Readiness	AI-integrated instructional design	Designing lessons using AI tools; adaptive learning paths; data-informed instruction; interactive content creation
	Assessment and feedback adaptation	Automated grading awareness; AI-based formative assessment; interpreting analytics for feedback
	Classroom management with AI	Monitoring engagement through AI systems; maintaining student autonomy; ethical use of behavior analytics
	Reflective pedagogy	Evaluating AI teaching outcomes; reflective practice journals; peer learning via AI
3. Cognitive Readiness	Conceptual understanding of AI	Knowledge of AI principles; differentiation between AI and automation; awareness of AI limits
	Critical thinking toward AI	Evaluating AI bias; interpreting algorithmic results; questioning data-driven insights
	Problem-solving ability	Using AI for problem analysis; scenario-based reasoning; creative integration of technology
4. Psychological Readiness	Attitude toward technology	Enthusiasm for innovation; openness to experimentation; curiosity about AI tools
	Self-efficacy in AI use	Confidence in using AI tools; coping with technical challenges; self-motivation
	Resistance and anxiety management	Overcoming fear of replacement; managing digital fatigue; addressing stress of technological change
5. Ethical Readiness	Data privacy and security awareness	Protecting student data; understanding privacy laws; safe storage practices
	Fairness and transparency	Avoiding algorithmic discrimination; ensuring fairness in automated decisions; understanding bias mitigation
	Professional accountability	Ethical AI application; responsibility for outcomes; adherence to institutional ethics policies
6. Organizational Readiness	Leadership and support	Administrative encouragement; strategic vision for AI; mentoring systems
	Policy and regulation awareness	Familiarity with national AI education policies; compliance with school guidelines; awareness of digital ethics frameworks
	Resource allocation	Budget for AI infrastructure; professional development funding; software licensing
	Collaboration networks	Teacher–administrator partnerships; interdisciplinary teams; knowledge sharing platforms
7. Cultural Readiness	Acceptance of innovation	Openness to change; social attitudes toward AI; collective learning culture
	Equity and inclusivity	Access equality; gender balance in tech adoption; supporting disadvantaged schools
	Value alignment	Compatibility with educational values; cultural sensitivity in AI design; ethical localization of AI tools

Technological Readiness: Technological readiness emerged as a foundational dimension of teachers' preparedness to integrate artificial intelligence in the teaching–learning process. Analysis revealed that effective AI integration requires a strong base of digital literacy, including proficiency in educational software, online collaboration, and data handling. Teachers also need operational knowledge of AI tools, such as chatbots, adaptive learning systems, and learning analytics, enabling them to incorporate automation effectively into pedagogical practice. In addition, access to reliable technological infrastructure—such as stable internet connections, adequate hardware, and technical support—was recognized as essential for ensuring equitable use of AI in classrooms. The final subtheme, continuous digital learning, highlighted teachers' motivation to stay updated with technological innovations through self-directed learning and professional development programs.

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Pedagogical Readiness: Pedagogical readiness encompassed the instructional and methodological capacities required for teachers to meaningfully employ AI within learning environments. The literature emphasized that educators must be able to design AI-integrated instructional activities, adapting lesson plans to incorporate data-driven personalization and interactive tools. They should also be competent in using AI for assessment and feedback, employing analytics-based systems to provide formative feedback while maintaining human oversight. Classroom management supported by AI tools—such as monitoring engagement or predicting learning difficulties—was found to enhance instructional efficiency, provided that ethical considerations and student autonomy are respected. Finally, reflective pedagogy, including evaluating outcomes of AI-based teaching and participating in peer-learning networks, was identified as a vital element for sustainable pedagogical growth.

Cognitive Readiness: Cognitive readiness referred to teachers' mental preparedness and intellectual competence in understanding, analyzing, and applying AI concepts. The findings underscored the importance of conceptual understanding of AI, including differentiating AI from automation, recognizing its potential, and acknowledging its limitations in education. Critical thinking toward AI was also crucial, as teachers must evaluate algorithmic biases and interpret data insights responsibly. Moreover, cognitive readiness involves robust problem-solving abilities, enabling educators to creatively use AI to address instructional challenges and develop adaptive solutions to classroom problems. These cognitive capabilities ensure that AI is used not as a substitute for human judgment but as an enhancement of professional decision-making.

Psychological Readiness: Psychological readiness captured teachers' emotional and motivational attitudes toward adopting AI technologies. This theme highlighted that a positive attitude toward technological innovation fosters openness to experimentation and curiosity about AI tools. Self-efficacy emerged as another key element, referring to teachers' confidence in managing AI applications and overcoming technical obstacles through persistence and intrinsic motivation. At the same time, the analysis revealed that resistance and anxiety toward AI remain barriers to adoption, often stemming from fears of job displacement, digital fatigue, or the stress associated with rapid technological change. Therefore, psychological support and training that reduce fear and build confidence are essential to enhance teachers' willingness to engage with AI systems.

Ethical Readiness: Ethical readiness emerged as a critical component of responsible AI integration in education. Teachers are expected to have awareness of data privacy and security issues, ensuring that student data are handled safely and in accordance with ethical and legal standards. The theme of fairness and transparency emphasized teachers' responsibility to prevent algorithmic discrimination, maintain transparency in AI-assisted decision-making, and mitigate biases in automated processes. Professional accountability also featured prominently, reflecting the need for educators to apply AI ethically, take responsibility for the consequences of its use, and adhere to institutional policies that safeguard ethical integrity. These elements collectively underscore the moral and professional framework required for trustworthy AI implementation in educational contexts.

Organizational Readiness: Organizational readiness referred to the institutional and administrative conditions that support teachers in adopting AI technologies. Leadership and managerial support were identified as pivotal factors—schools with visionary leaders and mentoring systems demonstrated greater success in fostering AI adoption. Awareness of national and institutional policies related to AI in education was also essential, as policy clarity provides a legal and ethical foundation for implementation. Resource allocation, including budgets for AI infrastructure, training, and licensing, was found to be necessary for sustaining readiness efforts. Additionally, the presence of collaborative networks, such as interdisciplinary teams and knowledge-sharing platforms, promoted a culture of cooperation and collective learning that strengthened organizational capacity for AI integration.

Cultural Readiness: Cultural readiness encompassed the broader societal and value-based conditions influencing teachers' acceptance of AI in the educational sphere. Acceptance of innovation, characterized by openness to change and collective learning attitudes, was identified as a cultural prerequisite for technological transformation in schools. The literature also emphasized equity and inclusivity, suggesting that readiness initiatives should ensure equal access to AI resources across different genders, socioeconomic groups, and educational settings. Finally, value alignment was noted as essential—AI adoption must resonate with local educational values, ethical norms, and cultural sensitivities. A culturally grounded approach

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ensures that technology serves pedagogical goals while respecting social diversity and moral boundaries.

In the second (quantitative) phase, the seven main readiness dimensions extracted from the qualitative analysis were prioritized based on teachers' perceptions using the Friedman ranking test. Data were collected from 200 teachers in Tehran, and all statistical analyses were conducted using SPSS version 26. The purpose of this phase was to determine the relative significance of each readiness dimension in facilitating teachers' adoption of artificial intelligence (AI) within the teaching–learning process. Mean ranks were computed to identify the most influential components, while standard deviations indicated response consistency among participants.

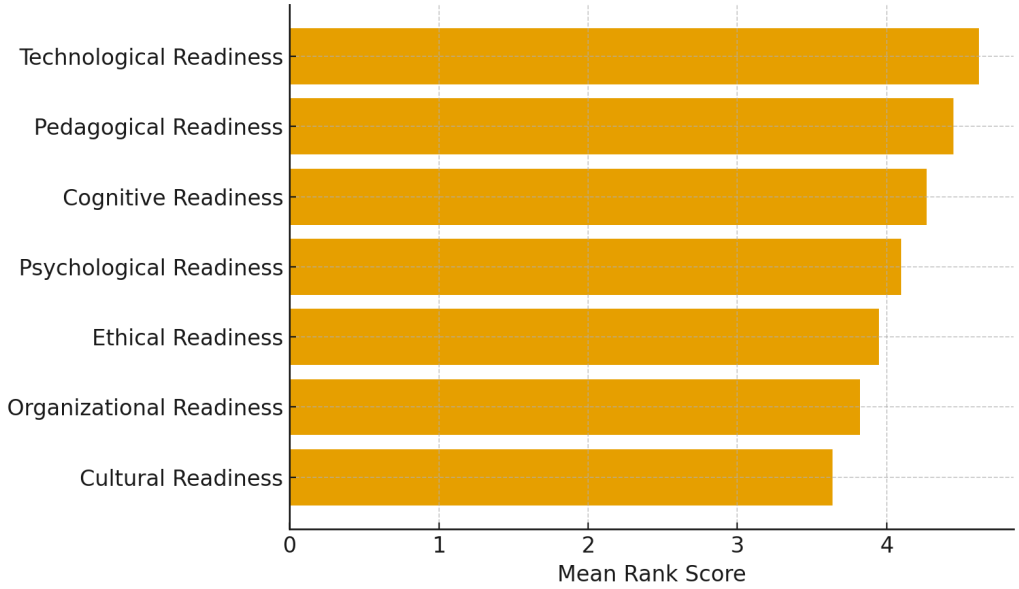
Table 2

Ranking of Teachers' Readiness Dimensions for Employing AI in the Teaching–Learning Process

Readiness Dimension	Mean Rank	Standard Deviation	Final Rank
Technological Readiness	4.62	0.54	1
Pedagogical Readiness	4.45	0.61	2
Cognitive Readiness	4.27	0.57	3
Psychological Readiness	4.10	0.66	4
Ethical Readiness	3.95	0.63	5
Organizational Readiness	3.82	0.69	6
Cultural Readiness	3.64	0.72	7

Figure 1

Ranking of Teachers' Readiness Dimensions for Employing AI in the Teaching–Learning Process



The ranking analysis revealed that technological readiness holds the highest priority among teachers, reflecting the critical importance of digital literacy, access to technological infrastructure, and operational familiarity with AI tools. Pedagogical readiness ranked second, highlighting the significance of teachers' ability to design AI-integrated learning environments and effectively use data-driven assessment. Cognitive readiness followed, emphasizing the need for conceptual understanding and critical thinking regarding AI applications. Psychological readiness was moderately ranked, showing that emotional attitudes, motivation, and self-efficacy play meaningful but secondary roles. Ethical readiness and organizational readiness ranked fifth and sixth respectively, indicating that while teachers acknowledge their importance, institutional and ethical factors may be less immediate concerns than practical and pedagogical aspects. Finally, cultural readiness received the lowest rank, suggesting that cultural attitudes toward innovation, though influential, are less prioritized in the immediate adoption phase of AI in education. Overall, the

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results demonstrate that readiness for AI adoption is multi-dimensional, with technical and pedagogical capacities forming the primary foundation upon which psychological, ethical, organizational, and cultural aspects build.

4. Discussion and Conclusion

The findings of this study revealed a comprehensive and hierarchical structure of teachers' readiness to employ artificial intelligence (AI) in the teaching–learning process. Based on the mixed-methods approach, seven primary dimensions of readiness were identified: technological, pedagogical, cognitive, psychological, ethical, organizational, and cultural. Quantitative ranking results showed that technological readiness was the most critical factor, followed by pedagogical and cognitive readiness, while cultural readiness ranked the lowest. These findings underscore that teachers' ability to integrate AI successfully in education is strongly influenced by their technical competence and instructional adaptability, which form the foundation for broader psychological and institutional acceptance.

The dominance of technological readiness aligns with global trends in AI adoption studies, emphasizing that basic digital literacy and familiarity with AI-based educational tools are prerequisites for effective integration (Wang et al., 2025; Yehya et al., 2025). Teachers who possess higher levels of technological proficiency are better positioned to explore adaptive learning systems, data analytics, and virtual learning environments (Santana, 2025). Qureshi et al. (Qureshi et al., 2025) similarly noted that teachers' perceptions of AI's ease of use and utility directly predict their adoption intentions. In line with Ofem et al. (Ofem et al., 2025), this study confirms that technological readiness is not an isolated skill but rather a multidimensional construct encompassing access to digital infrastructure, self-efficacy, and ongoing professional engagement. Ngongpah (Ngongpah, 2025) also found that insufficient competence in AI technologies remains one of the most significant barriers to readiness, particularly in developing educational systems. Therefore, the high ranking of technological readiness in the present research reflects the foundational role of technology competence as both an enabler and a confidence-building mechanism for AI adoption in classrooms.

Pedagogical readiness ranked second, reflecting the importance of instructional design and teaching adaptability in the AI-driven educational context. Teachers' ability to integrate AI tools into lesson planning, assessment, and student feedback mechanisms defines the practical utility of AI in classrooms (Liu et al., 2025). This finding supports earlier work by Khan (Khan, 2025), who demonstrated that pedagogical flexibility and digital instructional design mediate the relationship between AI adoption and student engagement. Similarly, Ii (Ii, 2025) emphasized that pedagogical readiness is interwoven with emotional and social competencies, allowing teachers to apply AI tools in ways that enhance inclusion and responsiveness in learning environments. Harakchiyska (Harakchiyska, 2025) also found that teachers' predisposition toward innovation strongly determines their pedagogical creativity in AI-supported contexts. Together, these findings suggest that the transition toward AI-enhanced education is not merely a technological process but a pedagogical evolution requiring teachers to redesign learning experiences that balance automation with human insight.

The third-ranked dimension, cognitive readiness, highlights teachers' conceptual understanding and critical awareness of AI technologies. As Fteiha et al. (Fteiha et al., 2025) observed, readiness extends beyond knowledge of AI tools—it includes the ability to critically analyze data, interpret algorithmic patterns, and evaluate technological bias. Farooq (Farooq, 2025) likewise identified psychological readiness as a bridge between cognitive competence and classroom innovation. The present findings corroborate this view, showing that cognitive readiness enables teachers to make informed judgments about when and how AI tools should be used to enhance learning outcomes. Dewi et al. (Dewi et al., 2025) found that pre-service teachers with higher analytical competence are more likely to demonstrate adaptive decision-making in technology-rich environments. In this regard, cognitive readiness is closely related to problem-solving ability, digital reasoning, and awareness of AI limitations—all of which are essential for the sustainable integration of intelligent systems into education.

Psychological readiness, which ranked fourth, reflects the emotional and motivational dimensions of AI adoption. Teachers who exhibit confidence, curiosity, and resilience are more likely to experiment with new technologies and maintain positive attitudes during implementation (Balasa, 2025). Abraham (Abraham & Sickel, 2025) found that self-efficacy mediates the relationship between readiness and professional engagement, confirming that belief in one's capability is central to overcoming resistance. Yue (Yue et al., 2024) and Yang (Yang et al., 2024) further demonstrated

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that teachers' self-efficacy in technology use predicts their willingness to integrate AI into daily teaching practices. Similarly, Shaari (Shaari & Kamsin, 2024) observed that readiness for flipped learning—a comparable innovation—depends heavily on psychological comfort with digital transformation. The current study aligns with these findings by emphasizing that emotional openness, motivation, and positive technological identity are integral to building sustainable readiness. Conversely, fear of obsolescence or lack of control can reduce enthusiasm and delay adoption, making psychological training and continuous mentorship critical components of readiness programs.

Ethical readiness ranked fifth, revealing growing recognition of the moral and legal implications of AI in education. Teachers increasingly confront questions surrounding data privacy, transparency, and algorithmic fairness (Sakitri et al., 2024). Rajapakse (Rajapakse et al., 2024) stressed that ethical awareness in AI usage is essential for maintaining trust and accountability in educational systems. The findings of Kitcharoen (Kitcharoen et al., 2024) similarly suggest that professional development programs integrating ethical considerations into AI training produce more conscientious practitioners. In this study, teachers acknowledged that AI-driven decisions—such as automated grading or behavior monitoring—must be approached with caution to prevent bias and safeguard student autonomy. Harakchiyska and Vassilev (Harakchiyska & Vassilev, 2024) also emphasized that fostering a sense of ethical responsibility among educators ensures that AI tools are applied to complement, not replace, human judgment. These findings affirm that readiness must encompass not only technical and pedagogical dimensions but also moral sensitivity and awareness of digital ethics.

Organizational readiness, ranked sixth, underscores the role of institutional support, leadership, and policy frameworks in enabling AI integration. According to Eke (Eke, 2024), the presence of strong administrative encouragement, clear policy guidelines, and access to technological infrastructure significantly influence teachers' preparedness levels. Alshorman (Alshorman, 2024) also highlighted that without systemic investment in training and technology, even the most enthusiastic teachers face constraints in applying AI effectively. This study confirms that organizational culture and leadership vision are key determinants of collective readiness. Schools that cultivate collaborative professional learning communities tend to achieve smoother AI implementation, consistent with findings by Zhang (Zhang & Villanueva, 2023), who introduced the concept of *generative AI preparedness* as an institutional as well as individual construct. Similarly, Öztürk (Öztürk & Turgut, 2023) and Li (Li et al., 2023) found that teachers' readiness correlates with institutional structures that provide continuous learning opportunities and feedback systems. Thus, readiness must be understood not only as an individual characteristic but as a systemic capability shaped by organizational design and resource allocation.

Finally, cultural readiness ranked lowest, indicating that while teachers recognize AI's potential, cultural attitudes toward innovation still moderate adoption behaviors. In many contexts, educators maintain traditional conceptions of teaching as a human-centered activity, making AI integration a culturally sensitive process (Devi et al., 2023). Abraham (Abraham & Sickel, 2025) and Yue (Yue et al., 2024) emphasized that readiness frameworks must align with local educational values and cultural expectations to ensure successful implementation. Yang (Yang et al., 2024) found that teachers working in collaborative and innovation-oriented cultures are more likely to engage in AI experimentation. Conversely, resistance can stem from fears that AI might diminish the humanistic dimensions of education. The present findings suggest that readiness policies must therefore incorporate cultural adaptation strategies—addressing teachers' values, norms, and identities to foster a more receptive environment for AI-enhanced learning.

Collectively, the findings confirm that readiness for AI integration is multidimensional and interactive. Technological and pedagogical competencies form the base of readiness, while psychological, ethical, organizational, and cultural dimensions reinforce long-term sustainability. This integrated model aligns with the global consensus that teacher preparation for AI should move beyond technical skill-building to encompass cognitive flexibility, emotional resilience, ethical literacy, and institutional support (Ofem et al., 2025; Wang et al., 2025). Moreover, this study provides empirical evidence for the prioritization of readiness components, offering actionable insights for policymakers and educational leaders seeking to implement AI-driven pedagogical reforms.

Although the study contributes to understanding the structure and prioritization of teachers' readiness for AI integration, several limitations should be acknowledged. First, the study's sample was limited to teachers from Tehran, which may restrict the generalizability of findings to other cultural and institutional contexts. Different regions

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may exhibit unique patterns of readiness influenced by infrastructure, policy, or cultural factors. Second, while the qualitative phase reached theoretical saturation through literature review, it did not include expert interviews or focus groups that could have provided deeper experiential insights. Third, the quantitative phase relied on self-report data, which may be subject to social desirability bias and overestimation of readiness. Finally, the cross-sectional design limits the ability to infer causality between readiness components and actual AI implementation outcomes. Longitudinal or experimental studies could better capture changes in readiness over time and the impact of targeted interventions.

Future research should explore readiness from a comparative and longitudinal perspective, examining how teachers' readiness evolves across educational stages and policy environments. Cross-cultural investigations could provide valuable insights into the influence of sociocultural values, institutional policies, and technological infrastructure on AI adoption patterns. Moreover, mixed-methods designs incorporating interviews, classroom observations, and case studies could yield a more nuanced understanding of how readiness dimensions interact in real instructional settings. Researchers are also encouraged to develop and validate standardized instruments for assessing AI readiness that integrate technological, ethical, and emotional domains. Finally, future studies could investigate how targeted professional development programs, leadership styles, and digital ecosystems influence the sustainability of teachers' readiness over time.

To translate the findings into practice, education policymakers and administrators should focus on building comprehensive readiness enhancement programs. Training initiatives must go beyond technical skill acquisition to include AI ethics, digital citizenship, and data privacy. Schools should cultivate professional learning communities that encourage peer mentoring and collaborative innovation. Institutional leaders must ensure equitable access to AI resources, fostering an environment of trust and continuous learning. Furthermore, readiness-building should be embedded in teacher education curricula, ensuring that pre-service and in-service teachers develop confidence and adaptability for AI integration. By aligning infrastructure, training, and culture, educational systems can create the necessary foundation for sustainable and ethical AI adoption in the teaching–learning process.

Authors' Contributions

Authors equally contributed to this article.

Declaration

In order to correct and improve the academic writing of our paper, we have used the language model ChatGPT.

Transparency Statement

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Declaration of Interest

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All procedures performed in studies involving human participants were under the ethical standards of the institutional and, or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

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