



Artificial Intelligence Literacy and Personalized Learning: Foundations, Implementation, and Educational Impact

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Abstract

Artificial Intelligence (AI) and personalized learning are increasingly transforming contemporary educational practices by shifting the focus from standardized instruction toward learner-centred, adaptive, and data-driven educational experiences. The present article examines the conceptual foundations, implementation mechanisms, educational impact, and challenges associated with the intersection of AI literacy and personalized learning. AI literacy is understood as a multidimensional competency extending beyond technical knowledge to include conceptual understanding, critical evaluation, ethical reasoning, awareness of algorithmic bias, privacy, and responsible engagement with AI technologies. Personalized learning, in turn, emphasizes individualization, learner-centredness, data-driven adaptation, and the accommodation of differences in learners' abilities, interests, learning pace, and progress. The review highlights the contribution of AI-driven adaptive learning platforms, recommender systems, learning analytics, intelligent tutoring systems, adaptive feedback mechanisms, and interactive AI tools in developing individualized learning pathways and enhancing learner engagement. It further emphasizes that effective AI-enabled personalized learning requires educators and students to possess adequate AI literacy so that AI-generated recommendations and outputs can be critically interpreted rather than passively accepted. The article also identifies major implementation challenges, including privacy and data security, educator preparedness, algorithmic bias, transparency, ethical concerns, and the potential overreliance on automated systems. Particular emphasis is placed on metacognitive skills, bias awareness, and bi-directional human-AI interaction as essential pedagogical strategies for responsible AI integration. The review concludes that the convergence of AI literacy and personalized learning has considerable potential to enhance learning outcomes, learner autonomy, critical thinking, engagement, and educational equity. However, realizing this potential requires interdisciplinary curricula, continuous professional development, robust data governance, critical AI literacy, and context-sensitive educational policies.

Keywords

Artificial Intelligence Literacy, Personalized Learning, Artificial Intelligence in Education, Adaptive Learning, Learner-Centred Education, Learning Analytics, Critical Thinking, AI Literacy, Educational Equity, Human-AI Interaction, Algorithmic Bias, Data Privacy.

1. Overview of Artificial Intelligence Literacy and Personalized Learning



Education has undergone significant transformation throughout history, with the current digital age marking a period of profound change. One of the most notable developments in this era is the emergence of personalized learning as a central strategy to address the diverse needs and objectives of individual learners. The concept of personalized learning has its roots in early educational research that emphasized individual differences, and it has evolved through various stages, including the era of computer-assisted instruction. Over time, personalized learning has become increasingly integrated into intelligent educational systems, incorporating recommender systems and learning analytics to better tailor educational experiences to individual students [1]. The advent of big data technologies has propelled personalized learning into a data-driven phase, enabling more nuanced and effective support for learners. This approach is characterized by its focus on the learner's level, ability, and progress, with the goal of achieving "individualized teaching, no class." By leveraging advanced technology and a sophisticated understanding of the learning process, personalized learning seeks to provide flexible and targeted educational experiences that are responsive to each learner's unique needs [1]. Personalized learning demonstrates efficacy not only in traditional classroom settings but also in online education, professional training, and career development contexts. Its significance lies in its ability to address individual differences, enhance learning outcomes, and foster a sustained interest in learning. Traditional one-size-fits-all teaching methods often fail to accommodate the varying speeds and styles of learners, as highlighted by Truong, who noted that presenting identical content to students with diverse interests and characteristics does not adequately meet their educational needs. In contrast, personalized learning dynamically adjusts both the content and delivery of instruction to align with each student's learning process [1]. This learner-centric approach elevates educational outcomes by considering individual needs and learning styles, tailoring experiences to maximize engagement and effectiveness. Personalized learning can refine content based on students' interests and proficiency levels, thereby stimulating enthusiasm and promoting independent learning. The approach has garnered considerable attention in recent years, as it embodies the humanistic ideals of education by transforming students from passive recipients into active participants and leaders in their own learning journeys. This shift not only enhances academic performance but also promotes educational equity by precisely addressing the needs of each student. FitzGerald et al. further emphasize that personalized learning is becoming a focal point in mass media, government policy, and scientific research, reflecting its growing prominence in contemporary educational discourse [1].

2. Related works

Research on artificial intelligence (AI) for personalized learning has its modern foundation in the "Deep Knowledge Tracing" (DKT) model proposed by Piech et al. [2]. DKT demonstrated that recurrent neural networks could infer a student's latent mastery state from interaction logs, establishing a data-driven paradigm for adaptive educational systems. Subsequent work has focused on improving representation capacity and interpretability—both of which are critical to advancing AI literacy among educators and learners. Pandey and Karypis introduced the attention-based "Self-Attentive Knowledge Tracing" (SAKT) model, showing that transformer mechanisms capture long-range dependencies more effectively than simple RNNs while offering transparent attention weights that can be used for explanatory feedback [3]. In parallel, Ghosh et al. proposed "AKT," which simplified the modeling pipeline and incorporated question semantics, thereby lowering the technical barrier for deploying personalized tutors in real classrooms [4]. Recognizing that conceptual relationships among skills are often explicit in curricular graphs, Yao et al. modeled student progress with graph neural networks, further aligning algorithmic reasoning with domain knowledge that teachers already understand [5]. Collectively, these developments have not only increased predictive accuracy but have also moved the field toward more interpretable and teacher-facing analytics, an essential step for fostering AI literacy and ensuring that personalized learning technologies translate into measurable educational impact.



3. Defining Artificial Intelligence Literacy

Artificial Intelligence (AI) literacy is an evolving concept that draws heavily from the established domain of digital literacy, reflecting the increasing integration of AI technologies into everyday life and professional contexts. Like digital literacy, which spans from basic computer skills to advanced problem-solving in digital environments, AI literacy encompasses a broad spectrum of competencies. These range from understanding the fundamental operations of AI systems to critically engaging with the societal and ethical implications of AI's pervasive presence in sectors such as finance, healthcare, and media. The growing ubiquity of AI underscores the necessity for a comprehensive understanding that enables individuals not only to use AI responsibly but also to participate as informed citizens and professionals in a technology-driven society [6]. Historically, the foundational frameworks for AI literacy were established prior to the emergence of advanced generative AI tools like ChatGPT, which have democratized access to AI and transformed public interaction with these technologies. This shift has exposed significant gaps in traditional educational paradigms, which have predominantly emphasized technical mastery—such as the mathematical underpinnings of AI, algorithmic principles, and programming skills. While this technical focus has been effective in cultivating expertise among AI developers and facilitating domain-specific upskilling, it has proven insufficient for the broader population, whose engagement with AI increasingly involves non-technical considerations [6]. A critical distinction has emerged between technical and non-technical AI literacy. Technical AI literacy involves the ability to design, develop, and implement AI systems, requiring a deep understanding of algorithms, data structures, and programming. In contrast, non-technical AI literacy encompasses the capacity to comprehend and critically evaluate the societal, ethical, and privacy-related dimensions of AI. However, this dichotomy is increasingly viewed as inadequate in the current socio-technical landscape, where the impact of AI extends beyond technical domains and permeates social norms, policy, and individual behavior. Consequently, there is a growing consensus that AI literacy must adopt a holistic approach, integrating conceptual understanding, ethical reasoning, and critical evaluation within an interdisciplinary framework [6]. Recent developments in AI education reflect this paradigm shift. Curricula are being updated to include not only technical content such as neural networks and practical AI applications but also topics related to ethics, fairness, and transparency. There is a concerted effort to embed AI literacy and critical thinking throughout computer science education, linking AI closely with data science and ensuring a balanced treatment of both symbolic and deep learning methodologies. This comprehensive approach is essential for fostering not only technical proficiency but also a nuanced appreciation of the complex socio-technical dynamics that characterize contemporary AI [6].

The definition and scope of AI literacy also vary according to the target audience. For K-12 students, AI literacy focuses on introducing basic concepts and everyday applications, aiming to cultivate early awareness and influence future educational and career trajectories. At the undergraduate level, particularly within computer science, the emphasis shifts to deep technical training, preparing students for roles as AI developers and researchers. However, AI literacy for non-computer science majors remains underdeveloped, highlighting the need for interdisciplinary curricula that integrate AI understanding into fields such as the humanities, social sciences, and business. For the general public, AI literacy encompasses both career reskilling—critical for adapting to industries transformed by AI—and general education that empowers individuals to make informed decisions about AI in their personal and professional lives. This broad, lifelong learning perspective ensures that AI literacy is not confined to formal education but extends across the lifespan, enabling continuous adaptation to technological change [6].

4. Core Principles of Personalized Learning



4.1 Individualization and Learner-Centricity

A foundational principle of personalized learning is its commitment to individualization, which involves tailoring educational experiences to the unique needs, abilities, and progress of each learner. This approach stands in stark contrast to traditional one-size-fits-all teaching methods, which often fail to accommodate the diverse learning speeds, interests, and styles present in any classroom. Personalized learning leverages insights from early educational research on individual differences and has evolved through the integration of computer-assisted instruction and intelligent educational systems. By dynamically adjusting both the content and delivery of instruction, personalized learning ensures that each student receives an educational experience aligned with their specific learning level and preferences. This learner-centric model transforms students from passive recipients into active participants and leaders in their own educational journeys, fostering greater engagement and motivation [1].

4.2 Data-Driven Adaptation and Technological Integration

The evolution of personalized learning has been significantly shaped by advancements in technology, particularly the rise of big data, learning analytics, and recommender systems. These technologies enable the continuous collection and analysis of learner data, allowing for real-time adaptation of instructional content and strategies. Personalized learning systems can fine-tune educational materials based on students' interests, proficiency levels, and learning styles, thereby enhancing both the relevance and effectiveness of instruction. This data-driven approach not only supports individualized teaching but also provides flexible and targeted learning experiences that can be implemented across various educational contexts, including traditional classrooms, online learning environments, and professional training settings. The integration of advanced technology thus amplifies the capacity of personalized learning to address individual differences and optimize learning outcomes [1].

4.3 Promotion of Educational Equity and Humanistic Ideals

Personalized learning is deeply rooted in the humanistic ideals of education, emphasizing the importance of meeting each learner's unique needs and fostering their intrinsic motivation. By precisely addressing individual differences, personalized learning promotes greater educational equity, ensuring that all students regardless of their starting point have the opportunity to succeed. This approach not only enhances academic performance but also cultivates a genuine enthusiasm for learning, as students are more likely to be engaged when their educational experiences resonate with their interests and strengths. The growing attention to personalized learning in mass media, government policy, and scientific research underscores its significance as a strategy for achieving both excellence and equity in education [1].

5. Intersection of AI Literacy and Personalized Learning

5.1 Synergistic Benefits of AI Literacy for Personalized Learning

The convergence of AI literacy and personalized learning represents a transformative shift in educational practice, enabling more tailored and effective learning experiences. AI-powered personalized learning systems leverage advanced algorithms to analyze extensive data on student performance, interests, and learning behaviors. This analysis allows for the creation of individualized learning paths, recommendations, and adaptive instruction that respond dynamically to each learner's



progress and mastery of concepts. As a result, students benefit from learning at their own pace, focusing on areas of personal interest, and receiving targeted support and feedback that is specifically aligned with their needs. The adaptive nature of these systems ensures that learners are consistently challenged at an appropriate level, which maximizes engagement and learning outcomes. Furthermore, the integration of AI literacy understanding how these systems function, their capabilities, and their limitations empowers both students and educators to make informed decisions about the use and interpretation of AI-driven recommendations, fostering a more transparent and participatory learning environment [7].

5.2 Interactive Engagement and Critical Thinking through AI Tools

AI literacy also enhances the effectiveness of personalized learning by facilitating deeper engagement and the development of critical thinking skills. AI-driven tools such as virtual assistants, chatbots, and intelligent tutoring systems provide interactive and responsive learning experiences. These tools can engage in real-time conversations, answer student questions, offer explanations, and supply additional resources, thereby supporting active learning. The instant feedback and guidance provided by AI systems encourage students to reflect on their understanding, ask questions, and explore concepts more thoroughly. This interactive engagement not only supports knowledge acquisition but also cultivates critical thinking and problem-solving abilities, as students learn to navigate and evaluate AI-generated insights. The ability to critically assess AI outputs is a core component of AI literacy, ensuring that learners do not passively accept recommendations but instead engage thoughtfully with the technology [7].

5.3 Challenges and Prerequisites for Effective Integration

Despite the significant potential of integrating AI literacy with personalized learning, several challenges must be addressed to realize its full benefits. Privacy and data security are paramount concerns, as personalized learning systems rely on the collection and analysis of sensitive student data. Ensuring the ethical use and protection of this data is essential to maintaining trust and safeguarding student rights. Additionally, the successful implementation of AI-powered personalized learning requires that educators themselves possess a foundational level of AI literacy. Educators need training and ongoing support to effectively integrate AI technologies into their teaching practices, interpret AI-generated insights, and guide students in the responsible use of these tools. Addressing these challenges is critical for fostering an educational environment where AI literacy and personalized learning can mutually reinforce each other, leading to more equitable and impactful learning experiences [7].

6. Technological Tools Enabling Personalized Learning

6.1 AI-Driven Adaptive Learning Platforms

A central pillar of personalized learning is the deployment of AI-driven adaptive learning platforms that tailor educational experiences to individual student needs. OpenEdX, co-founded by Harvard and MIT, exemplifies this approach by leveraging AI to analyze learner data and generate personalized course recommendations and adaptive learning pathways. The system identifies each learner's strengths and areas for improvement, curating course selections that align with their interests and aspirations. This targeted recommendation process not only enhances student engagement but also increases motivation by ensuring that learning materials are relevant and appropriately challenging [8]. Similarly, Coursera utilizes AI algorithms to continuously assess learner progress, pinpointing strengths and weaknesses to dynamically adjust the learning path. By personalizing both content and activities, Coursera enables



students to focus on areas requiring further attention, thereby accelerating their learning progress. This dynamic adaptation ensures that learners receive the support they need precisely when they need it, optimizing educational outcomes [8].

6.2 Adaptive Content and Feedback Systems

Beyond course recommendations, AI technologies are increasingly used to adapt the complexity and nature of instructional content in real time. Duolingo, a prominent language-learning platform, employs AI to evaluate learner performance and tailor exercises and lessons according to individual progress. This adaptive methodology ensures that learners are consistently challenged at an appropriate level, receiving targeted instruction that addresses their unique learning needs. Such customization not only sustains learner engagement but also supports more effective skill acquisition [8]. Khan Academy further illustrates the power of AI in personalizing learning through its use of data analytics and algorithmic analysis of student performance, progress, and preferences. The platform generates individualized learning paths, recommending specific content and exercises tailored to each student's needs. By adapting to the learner's pace and focusing on areas requiring additional support or challenge, Khan Academy enables students to learn at their own speed and achieve optimal outcomes. The recent introduction of Khamigo, an AI-powered guide based on GPT-4, extends this personalization by analyzing student responses and providing instant, tailored feedback. Khamigo supports both students and teachers, complementing traditional instruction and fostering deeper understanding through adaptive, real-time guidance [8].

6.3 Immersive and Interactive AI Experiences

Innovative AI architectures, such as Generative Adversarial Networks (GANs), are expanding the horizons of personalized learning by enabling immersive and interactive educational experiences. Recent advancements have demonstrated the potential for students to engage directly with virtual representations of historical figures relevant to their studies. For example, students exploring physics can interact with a virtual Einstein, while those in art classes might engage with the Mona Lisa. These AI-generated interactions immerse learners in the subject matter, fostering a deeper connection with the content and stimulating curiosity and enthusiasm. By bringing historical luminaries to life, such tools not only personalize the learning experience but also enhance engagement and motivation, contributing to more meaningful and memorable educational outcomes [8].

7. Pedagogical Strategies for AI Literacy Development

7.1 Integrating Metacognitive Skills and Bias Awareness

Recent scholarship emphasizes that effective AI literacy development must extend beyond the acquisition of technical skills to include metacognitive competencies, particularly those that enable learners to recognize and address biases in human-AI collaboration. Pedagogical strategies should therefore be designed to foster critical evaluation of AI-generated content, moving students away from uncritical acceptance of AI outputs as inherently authoritative. Tools such as DeBiasMe exemplify this approach by embedding deliberate friction into the learning process, prompting students to pause and reflect on the reliability and potential biases of AI recommendations. This friction is not merely a barrier but a pedagogical device that cultivates metacognitive awareness, encouraging learners to interrogate both their own cognitive biases and those embedded within AI systems. By foregrounding bias awareness, these strategies aim to produce learners who are not only technically proficient but also critically engaged and reflective in their interactions with AI technologies [9].



7.2 Bi-directional Human-AI Interaction and Learner-Centered Engagement

Another key pedagogical strategy involves the design of bi-directional human-AI interaction interventions that support diverse user engagement patterns. Rather than positioning AI as a static source of information, these approaches encourage dynamic exchanges where learners actively question, challenge, and refine AI outputs. This learner-centered model recognizes the complexity of human-AI interactions and seeks to empower students to navigate these complexities through iterative dialogue and feedback. By supporting a range of engagement styles, such strategies accommodate individual differences in learning preferences and cognitive styles, thereby promoting inclusivity and deeper understanding. The emphasis on bi-directional interaction also aligns with broader trends in learner-centered artificial intelligence in education (AIED), where the goal is to augment-not replace-human judgment and agency in the learning process. These pedagogical innovations represent a promising direction for future research and practice in AI literacy education, as they seek to balance the affordances of AI with the critical capacities of human learners [9].

8. Challenges and Barriers in Implementation

8.1 Privacy and Data Security Concerns

A significant challenge in the implementation of AI-driven personalized learning systems is the issue of privacy and data security. AI-powered educational tools rely on the collection and analysis of vast amounts of student data, including performance metrics, learning behaviors, and personal interests, to tailor learning experiences and provide adaptive instruction. While this data-driven approach enhances the personalization and effectiveness of learning, it also raises critical concerns regarding the ethical use and protection of sensitive student information. Ensuring that student data is securely stored, transmitted, and processed is paramount to maintaining trust in AI systems and safeguarding against potential breaches or misuse. The need for robust data governance frameworks and transparent policies is underscored by the potential risks associated with unauthorized access, data leaks, or the exploitation of personal information for unintended purposes. Addressing these privacy and security challenges is essential for the responsible adoption of AI in educational settings and for upholding the rights and safety of learners [7].

8.2 Educator Preparedness and Professional Development

Another major barrier to the effective implementation of AI in personalized learning is the preparedness of educators to integrate these technologies into their teaching practices. The successful adoption of AI-powered tools requires educators to possess not only a foundational understanding of artificial intelligence concepts but also the skills to interpret and utilize AI-generated insights in meaningful ways. Many educators may lack the necessary training or confidence to leverage AI systems effectively, which can hinder the realization of the full benefits of personalized learning. Professional development programs and ongoing support are crucial to equip teachers with the knowledge and competencies needed to navigate the complexities of AI integration. This includes understanding how to interpret adaptive feedback, adjust instructional strategies based on AI recommendations, and address ethical considerations related to data use. Without adequate training and support, there is a risk that AI technologies may be underutilized or misapplied, limiting their potential impact on student learning outcomes [7].

8.3 Ethical and Pedagogical Considerations



The implementation of AI in personalized learning environments also presents ethical and pedagogical challenges that must be carefully considered. Beyond privacy and security, ethical concerns include ensuring fairness and avoiding biases in AI algorithms that could disadvantage certain groups of students. There is a need for transparency in how AI systems make decisions and recommendations, as well as mechanisms for accountability and recourse in cases where students or educators perceive harm or inequity. Pedagogically, the integration of AI tools must be aligned with sound educational principles to support not supplant human judgment and the teacher-student relationship. Overreliance on AI-generated feedback or recommendations could inadvertently diminish the role of educators or reduce opportunities for critical thinking and human interaction. Balancing the strengths of AI with the irreplaceable value of human guidance remains a central challenge in the ongoing evolution of personalized learning [7].

9. Impact on Student Outcomes and Educational Equity

9.1 Enhancement of Student Learning Outcomes

Personalized learning, underpinned by artificial intelligence and data-driven technologies, has demonstrated a significant capacity to improve student learning outcomes. By leveraging insights into individual learning levels, abilities, and progress, personalized learning systems dynamically adjust instructional content and delivery to suit each learner's unique profile. This tailored approach stands in stark contrast to traditional one-size-fits-all teaching methods, which often fail to accommodate the diverse learning speeds, interests, and styles present within a classroom. Research indicates that when educational experiences are customized to align with students' individual needs and preferences, learners exhibit heightened engagement, increased motivation, and improved academic performance. The flexibility and adaptability of personalized learning not only foster a deeper understanding of subject matter but also encourage the development of independent learning skills, as students are empowered to take an active role in their educational journey. This shift from passive reception to active participation is central to the learner-centric philosophy of personalized learning, which seeks to cultivate both academic achievement and a sustained enthusiasm for learning [1].

9.2 Addressing Educational Equity

Beyond its impact on individual achievement, personalized learning holds considerable promise for advancing educational equity. By precisely targeting the specific needs of each student, these systems can help bridge gaps that arise from differences in prior knowledge, learning pace, and personal interests. Traditional instructional models, which deliver uniform content to all students regardless of their backgrounds or abilities, often perpetuate disparities by failing to support those who require additional assistance or alternative approaches. In contrast, personalized learning environments are designed to identify and respond to these differences, ensuring that every learner receives the support necessary to succeed. This capacity to tailor educational experiences not only enhances academic outcomes for all students but also promotes fairness and inclusivity within the educational system. As personalized learning becomes increasingly prominent in educational policy, research, and media discourse, its role in fostering both excellence and equity is gaining recognition as a cornerstone of modern educational practice [1].

10. Future Directions and Policy Implications

10.1 Refining Conceptual Frameworks and Terminology



The evolving landscape of artificial intelligence literacy necessitates a more nuanced and precise conceptual framework. The review of 124 studies highlights that both “AI” and “literacy” are multifaceted constructs, each encompassing a range of skills and knowledge that are context-dependent. For instance, the technical literacy required by AI engineers differs fundamentally from the critical literacy needed by citizens engaging with AI policy or consumers making informed choices about AI products. The current ambiguity in the term “AI literacy” has led to a proliferation of interventions and educational programs that, while sharing the same label, often pursue divergent objectives and employ distinct pedagogical approaches. This lack of specificity can hinder effective communication among researchers, educators, and policymakers, and may impede the development of targeted curricula and assessment tools. Therefore, a key future direction is the adoption of more precise terminology that distinguishes between technical, tool-based, and sociocultural perspectives on AI, as well as between functional, critical, and indirectly beneficial forms of literacy. Such clarity will facilitate more focused research, enable practitioners to better articulate their educational goals, and support policymakers in crafting regulations and guidelines that are responsive to the diverse dimensions of AI literacy [10].

10.2 Addressing Research Gaps and Expanding Critical Literacy

The review identifies significant gaps in current AI literacy research, particularly in the promotion of critical literacy among students interacting with AI tools. While recent trends have seen a shift toward teaching effective use of generative AI- especially in post-secondary contexts, where prompt engineering and tool proficiency are emphasized- there remains a pressing need to cultivate critical perspectives. Critical literacy involves not only understanding how AI systems function, but also interrogating their broader societal, ethical, and cultural implications. As AI tools become increasingly ubiquitous in educational and everyday contexts, fostering critical literacy will be essential to empower learners to navigate issues such as algorithmic bias, data privacy, and the sociopolitical impact of AI technologies. Future research should prioritize the development and evaluation of interventions that integrate critical literacy components, ensuring that students are equipped not only to use AI tools effectively, but also to engage thoughtfully with the challenges and opportunities these technologies present. This direction is particularly urgent given the rapid proliferation of generative AI and the corresponding expansion of AI literacy initiatives into both K-12 and post-secondary education [10].

10.3 Policy Implications for Curriculum Design and Educational Equity

The shifting focus of AI literacy research-from technical and ethical foundations in K-12 settings to tool-based proficiency in post-secondary education-has important implications for educational policy and curriculum design. Policymakers must recognize the need for differentiated approaches that reflect the varying objectives and contexts of AI literacy education. For example, K-12 curricula may benefit from a balanced emphasis on both technical understanding and ethical considerations, while post-secondary programs might prioritize advanced tool use and domain-specific applications. Additionally, the emergence of studies highlighting the indirect benefits of AI literacy, such as increased interest in STEM fields, suggests that AI literacy initiatives could play a role in promoting broader educational and workforce development goals. To ensure equitable access to these opportunities, policies should address potential disparities in resources, teacher training, and curricular integration across different educational settings. By supporting research-informed, context-sensitive approaches to AI literacy, policymakers can help prepare learners to participate fully and responsibly in an AI-driven society [10].

11. Conclusion



This article provides a comprehensive examination of the intersection between artificial intelligence (AI) literacy and personalized learning, highlighting their mutual reinforcement and the transformative potential for educational practice. The synthesis of AI literacy with personalized learning principles such as individualization, data-driven adaptation, and the promotion of educational equity demonstrates that AI tools can significantly enhance learner engagement, critical thinking, and tailored educational experiences. The deployment of AI-driven adaptive platforms, feedback systems, and immersive technologies further supports the realization of learner-centric environments. The effective integration of AI literacy into personalized learning is contingent upon addressing several challenges. These include ensuring privacy and data security, enhancing educator preparedness through targeted professional development, and navigating complex ethical and pedagogical considerations. The article underscores the necessity of metacognitive skill development, bias awareness, and bi-directional human-AI interaction to foster critical and reflective engagement with AI technologies. Empirical evidence suggests that the convergence of AI literacy and personalized learning can lead to improved student outcomes and contribute to greater educational equity, provided that implementation barriers are systematically addressed. Future directions call for the refinement of conceptual frameworks, expansion of critical AI literacy research, and the formulation of informed policy measures to guide curriculum design and equitable access. Collectively, these efforts are essential to harness the full potential of AI in creating inclusive, adaptive, and effective educational systems.

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