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A Study on Digital Literacy of Chinese Secondary School Teachers in the Era of Artificial Intelligence

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Abstract: The purpose of this paper is to provide a comprehensive overview of the current state of research on digital literacy among Chinese secondary school teachers in the age of artificial intelligence, and to explore its application and impact in teaching practice. First, this paper analyzes the evolution of digital literacy, especially in response to the challenges of artificial intelligence, and proposes the competency needs of teachers in information technology, data management, and algorithmic awareness. Second, the paper summarizes the understanding and practice of teachers' digital literacy in both domestic and international studies, points out the challenges faced by teachers in the process of enhancing digital literacy, such as technological resistance, insufficient training, and uneven resources, and also identifies the potential of AI tools in teacher training, which are able to promote the enhancement of teachers' competence through personalized learning. Finally, the article offers specific recommendations for improving the digital literacy of teachers in China, emphasizing the need for practical policies and training programs to respond to changing educational needs. The study suggests that the improvement of teachers' digital literacy not only contributes to the quality of education, but is also key to the realization of AI-driven educational transformation.

Keywords: Artificial Intelligence, Digital Literacy, Teacher Training, Education Transformation.

1. Introduction

With the advent of the digital age, the field of education is undergoing profound changes, and artificial intelligence (AI) technology, as a key driver thereof, is continuously influencing global education trends. China is also actively promoting the modernization of education in this digital wave, especially in improving teachers' digital literacy. Teachers play a crucial role in this transformation process, especially in adapting and applying AI technology in classroom teaching, and the improvement of their digital literacy is crucial.

First, this article aims to provide a systematic overview of research on digital literacy of Chinese secondary school teachers in the era of AI, and comprehensively discuss the importance of digital literacy in teacher education. The article analyzes how teachers can effectively integrate digital tools and teaching resources in the AI environment, as well as the challenges and opportunities they face in their teaching practice. Second, the article focuses on examining the current domestic and international research on teachers' digital literacy, revealing the shortcomings of the existing research and proposing directions for improvement for teacher training, especially in the cultivation and application of AI skills. Finally, the article points out the need to develop training frameworks for teachers that are adapted to AI-driven education so that they can adequately respond to changing educational needs and utilize AI tools to improve the quality of classroom teaching. Combined with the actual needs of Chinese secondary school teachers, this study provides strong theoretical support for the development of future education policies, the improvement of teacher training systems, and the transformation of education in the AI era.

2. Digital Literacy Framework Explained

In the context of secondary education, especially in China, digital literacy represents more than just the ability to use technology. It is an evolving set of skills that are critical for both educators and students to navigate in an increasingly digital and data-driven world. This section delves into the definition of digital literacy, the expansion of its scope in response to AI advances, the impact of these changes on educators, and how digital literacy affects teaching and learning practices.

2.1. Definition and Evolution of Digital Literacy

Traditional definitions of digital literacy have typically focused on basic technological competencies, such as the ability to use computers, the Internet, and software tools. Historically, digital literacy has been viewed as a set of technical skills necessary for personal and professional functioning in the modern world. In educational settings, it is defined by the ability of educators and students to access, evaluate, and communicate information through digital platforms[1].

The definition of digital literacy has expanded significantly with advances in technology. The rise of Artificial Intelligence (AI), Big Data, and automated systems clearly demonstrates the need for educators to go beyond basic technical skills to navigate and critically evaluate information in increasingly complex digital environments. Digital literacy in the 21st century now includes skills such as the interpretation of data, the ethical use of technology, and the ability to use algorithmic systems[2].

In the context of AI, digital literacy must include a basic understanding of how AI systems work, the impact of data collection, and how algorithms affect decision-making in educational and social settings. The evolution of digital literacy reflects the growing importance of understanding the interplay between human cognition and technology, with an emphasis on critical thinking, ethical decision-making, and adaptability in a rapidly changing digital environment.

2.2. Artificial Intelligence and Digital Literacy

AI has profoundly redefined digital literacy, especially for educators, by introducing a range of new capabilities that were previously less emphasized. As educational institutions integrate AI technologies such as personalized learning platforms, automated assessment tools, and AI-driven classroom management systems, educators must become familiar with these innovations to use them effectively.

Key AI-related competencies in digital literacy include:

(1) Data Management

Educators must be able to handle the vast amounts of data generated by students and educational platforms. This involves not only understanding data privacy and security issues, but also being able to interpret data trends that inform instructional practices[3].

(2) Algorithm Awareness

Educators need to understand how algorithms work and how they shape the educational experience. This includes recognizing the potential biases embedded in AI systems and their impact on students.

(3) Ethical Considerations

As education becomes increasingly reliant on AI, teachers must also grapple with ethical dilemmas regarding student data use, algorithmic decision-making, and the broader impact of AI on society. Issues such as bias in AI systems, privacy concerns, and equitable access to AI technology are key areas where digital literacy plays an important role.

For secondary school teachers in China, integrating AI into education requires attention to these new dimensions of digital literacy to ensure that educators not only understand how to use AI tools, but also critically engage with the broader societal implications of these technologies[4].

2.3. The Role of Digital Literacy in Effective Teaching and Learning

Digital literacy plays a key role in developing effective teaching strategies, classroom management, and student engagement. In the age of AI, teachers are increasingly relying on digital platforms and tools to enhance their teaching practices. However, the effective use of these technologies depends on teachers' digital literacy, which enables them to leverage these tools to create more interactive, personalized, and dynamic learning environments.

(1) Instructional Strategies

Digital literacy enables teachers to design and implement a variety of instructional strategies that utilize technology to support student learning. This may include using AI-driven platforms to personalize instruction, integrating digital media into lesson plans, or adopting flipped classroom models that encourage collaborative learning[5]. Teachers with strong digital literacy skills can adapt to the rapidly changing technological landscape and seamlessly integrate new tools and approaches into their instructional practices.

(2) Classroom Management

Digital literacy also enhances effective classroom management.AI-driven tools can help teachers track student progress, identify learning gaps, and provide real-time feedback. In addition, digital platforms can help streamline administrative tasks such as grading, attendance, and communication with parents. Digitally literate teachers can effectively manage both face-to-face and virtual classrooms, creating a more organized and supportive learning environment.

(3) Student Engagement

Digital literacy enables teachers to engage students in new ways and foster more interactive and engaging learning experiences. Artificial intelligence and other digital tools can create adaptive learning environments in which students receive content tailored to their individual needs, leading to increased motivation and engagement. Teachers can use data analytics to monitor student progress and adjust instructional strategies accordingly, ensuring that every student has the support they need to succeed.

The importance of digital literacy for ongoing teacher professional development cannot be overemphasized. In the age of AI, educators must continually update their skills to remain effective in the classroom. This requires ongoing professional development opportunities that focus not only on the technical aspects of using AI tools, but also on the ethical and pedagogical considerations associated with these technologies.

Effective professional development programs should emphasize the integration of AI and other emerging technologies into teaching practice, while also fostering critical thinking about the broader implications of these tools in education. Digitally literate teachers can be leaders in the classroom, guiding students to develop the skills they need to succeed in the digital world.

3. Global and Domestic Perspectives on Teachers' Digital Literacy

3.1. International Research on Teachers' Digital Literacy

International research on teacher digital literacy reveals several key themes and findings that highlight the importance of digital competence in contemporary education. An important theme is the need for teachers to develop key digital literacy skills, not just technological proficiency. For example, research emphasizes the role of digital literacy in developing potential teachers' critical thinking and manipulative skills, suggesting that digitally based modules can be effective in enhancing these competencies. In addition, research suggests that teachers' beliefs about digital literacy significantly influence their integration of technology into the classroom, and that supportive environments are critical to fostering positive attitudes toward digital tools. Best practices in developed countries often include comprehensive frameworks to guide teacher training and professional development. For example, frameworks such as the Teachers' Digital Competence (TDC) Framework provide a structured approach to enhancing teachers' digital competence, with a focus on integrating technology into teaching practice. In addition, research has emphasized the importance of collaborative learning environments in which teachers can share experiences and strategies for the effective use of digital technologies. Such collaborative practices are critical to overcoming barriers to technology integration, which often include limited resources and restrictive curricula[6].

3.2. Digital Literacy of Chinese Secondary School Teachers

Research focusing on the digital literacy of secondary school teachers in the Chinese context identifies both strengths and challenges[7]. A notable strength is the growing recognition of the importance of digital literacy in teacher education, supported by national policies aimed at improving

the quality of education through technology integration. However, challenges remain, including disparities in teachers' access to digital resources and varying degrees of digital competence, especially in rural areas[8]. National policies and programs play a key role in promoting digital literacy among Chinese teachers. Initiatives aimed at improving digital competence are often linked to broader education reforms that emphasize the integration of technology into the teaching and learning process. For example, the Chinese government has implemented strategies to improve teachers' digital literacy, recognizing its critical role in preparing students for a digital future. However, the effectiveness of these policies is often hampered by a lack of adequate training and resources, which can hinder teachers' ability to fully adopt digital tools in the classroom.

3.3. Comparative Analysis of Domestic and International Studies

A comparative analysis of global findings and domestic studies reveals the unique challenges and opportunities that Chinese secondary school teachers face in developing digital literacy. While the international studies emphasized the importance of collaborative practices and supportive environments for integrating digital literacy, similar themes emerged in the Chinese context, despite the obvious challenges in resource availability and training. In addition, China's cultural and educational landscape offers unique opportunities for leveraging digital literacy programs. For example, the rapid development of technology in urban areas contrasts with slower adoption in rural areas, highlighting a digital divide that needs to be addressed. This divide presents challenges and opportunities for targeted interventions that can bridge the gap and promote equitable access to digital literacy education. In conclusion, while there are commonalities in the global discourse on teachers' digital literacy, the specific context of China requires tailored approaches that take into account local challenges and capitalize on existing strengths in teacher education and policy frameworks.

4. The Challenge of Improving Chinese Teachers' Digital Literacy

4.1. Barriers to Digital Literacy Development

4.1.1. Unequal Access to Regional Resources

A significant barrier to improving the digital literacy of secondary school teachers in China is the unequal distribution of educational resources. Urban schools typically have easier access to technology, while rural and underfunded schools face challenges in accessing digital tools and reliable internet. This disparity limits teachers' ability to integrate technology into their teaching and hinders the development of their own digital skills.

4.1.2. Differences in Digital Literacy Across Regions, Age Groups, and Subjects

The level of digital literacy among teachers in China varies widely. Teachers in urban areas are typically more digitally literate, while those in rural areas often do not have access to the training and resources needed to improve their skills. Age is also a factor, as older teachers may be less comfortable with new technologies than their younger, more tech-savvy colleagues. In addition, digital literacy varies by subject area, with teachers in subjects such as languages facing more challenges in integrating technology than teachers in science and technology subjects.

4.1.3. Resistance to Adopting New Technologies and the Need for Professional Development

Despite the obvious benefits of digital literacy, many teachers showed resistance to adopting new technologies. This reluctance stems from concerns about complexity, lack of confidence, and the time and effort required to learn new tools. In addition, professional development opportunities available to teachers are often insufficient and fragmented, making it difficult for educators to keep up with the latest technologies. To address these issues, comprehensive, ongoing training is essential to help teachers feel more confident and competent in using digital tools in the classroom.

4.2. AI- Specific Challenges

4.2.1. Lack of Artificial Intelligence Competencies

As AI is increasingly integrated into education, many teachers lack the specific competencies needed to effectively use AI tools. While basic digital literacy is common, skills to understand AI algorithms, use AI to personalize learning, and integrate AI tools into pedagogical approaches require specialized training. Rapid advances in AI further complicate this issue as teachers struggle to keep up with new technologies. Targeted, ongoing professional development is necessary to equip teachers with the skills to incorporate AI into their teaching practices.

4.2.2. Ethics and Data Privacy

Using AI in the classroom also raises important ethical and data privacy issues. Teachers are often unsure how to handle the large amounts of student data collected by AI tools, including issues related to data security, consent, and potential algorithmic bias. These issues can hinder the adoption of AI in education, as teachers may be reluctant to use tools without a clear understanding of how to responsibly manage these risks. To address this, teacher training programs must include guidance on AI ethics, data protection, and ensuring fairness and transparency in AI applications.

5. Opportunities to Improve Teachers' Digital Literacy

5.1. Policy and Institutional Support

5.1.1. Government Policy on Teachers' Digital Literacy

In recent years, the Chinese government has focused on improving teachers' digital literacy through various initiatives. National policies, such as the National Medium- and Long-Term Education Reform and Development Plan (2010-2020), emphasize the need for teachers to develop digital skills. The Ministry of Education (MOE) has issued “Digital Literacy for Teachers” as an industry standard in the field of education. However, the implementation of these policies remains uneven, especially in rural areas where resources are limited.

5.1.2. Role of Government and Educational Institutions

Both government agencies and educational institutions are crucial in improving teachers' digital literacy. The central government provides financial support and policy guidance, while local governments are responsible for adapting these initiatives to regional needs. Universities and teacher training colleges also play a key role in providing programs that develop basic digital skills and AI-related competencies. Collaboration among these stakeholders is essential to ensure

that efforts to improve teachers' digital literacy are implemented on a national scale.

5.2. Teacher Training and Professional Development

5.2.1. Ongoing AI- Focused Training

Ongoing professional development is critical for teachers to keep up with the rapidly evolving digital landscape. AI-focused training programs can help teachers learn how to effectively use AI tools in the classroom. From personalized learning to AI-driven assessments, AI-focused professional development equips teachers with the skills they need to integrate these technologies into their teaching. Ongoing training ensures that teachers stay current with emerging tools and practices.

5.2.2. Collaboration Among Teachers, Policymakers, and Technology Providers

Effective teacher training requires collaboration among educators, policymakers, and technology providers. Policymakers can identify key areas for improvement, while technology providers can offer insights on the latest tools and solutions. By sharing their practical experiences, teachers help ensure that training programs and technology meet classroom needs. This partnership can create more relevant and impactful professional development programs.

5.3. Integration of Artificial Intelligence in Teacher Training

5.3.1. AI Tools for Personalized Training

AI can transform teacher training by delivering personalized learning experiences. AI-powered platforms can assess teachers' digital skills, identify gaps, and create custom training paths. These platforms provide real-time feedback, track progress, and offer relevant resources tailored to each teacher's needs, making professional development more effective and efficient.

5.3.2. Artificial Intelligence for Reflective Practice and Skill Enhancement

Artificial intelligence-powered platforms can also support teachers in reflecting on their pedagogy. By analyzing lesson plans, teaching strategies, and student performance, AI tools can help teachers assess their effectiveness and improve their practice. In addition, these platforms can recommend digital tools and resources to further enhance teachers' skills and ensure their digital literacy and use of AI in the classroom continues to improve.

These opportunities highlight how policy support, targeted training, and AI tools can help improve teachers' digital literacy. By utilizing these strategies, China can develop a more digitally savvy teaching force and better integrate AI into education.

6. Conclusions

Through a systematic review of Chinese secondary school teachers' digital literacy in the AI era, this paper reveals the core competency needs and challenges faced by teachers in the emerging technological environment. First, the study shows that the improvement of digital literacy is the key for teachers to cope with educational changes in the AI era, covering multiple dimensions such as technology application, data analysis, algorithmic awareness, and ethical issues. Second, teachers' competency gaps in AI application, especially the adaptation of AI tools and the development of critical thinking, remain a weak point in the current education system. In addition, the study highlights the direct impact of teachers' digital literacy on the quality of teaching and learning, including classroom management, increased student engagement, and the development of personalized teaching strategies. Finally, this paper suggests that, in addition to relying on national policy and resource support to promote teachers' digital literacy, there is a need to strengthen the continuity and relevance of teachers' professional development, especially in AI application training. The research in this paper provides important theoretical support and practical guidelines for the educational transformation of Chinese secondary school teachers in the era of AI. The results of the study not only contribute to the development of educational policies and the improvement of the teacher training system, but also provide valuable ideas for the in-depth development of the AI-driven education model in the future.

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