

# Rich Connotation, Realistic Dilemma, and Practical Path of Teachers' Digital Literacy in the Era of Digital Intelligence

Limei Fu\*

Hainan Vocational University of Science and Technology, Haikou 571126, Hainan Province, China

\*Corresponding author: Limei Fu, orange2022155009@163.com

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**Abstract:** With the rapid development of information technology and the popularity of the Internet, digital education has become an important direction of modern education reform. Digital education provides a new way and tool for education and teaching, so that teachers and students can make better use of the application of information technology in the teaching process. Teachers' digital literacy has become the key to realize digital education. In the digital age, the level of teachers' digital literacy directly affects teachers' teaching effect and students' learning results. Therefore, improving teachers' digital literacy has become an urgent task of education reform.

**Keywords:** Digital literacy; Teacher development; Practice path

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## 1. Introduction

Recently, the National Network Information Office, the Ministry of Education, the Ministry of Industry and Information Technology, and the Ministry of Human Resources and Social Security jointly issued the "Key Points for Improving Digital Literacy and Skills for All by 2022," and digital literacy has once again become the focus of widespread discussion in society. In 2022, the Ministry of Education issued a notice on the publication of the "Teacher Digital Literacy" education industry standard, with the aims to promote the national education digitization strategy, improve the education informatization standard system, and enhance teachers' awareness, ability, and responsibility to use digital technology to optimize, innovate, and change education and teaching activities. In the face of new standards and requirements, teachers need to improve their digital literacy level through professional development activities.

## 2. Analysis of the development status of teachers' digital literacy

### 2.1. Connotation of digital literacy

The proposal and development of digital literacy can be traced back to the late 1980s and early 1990s. At

that time, the rapid development of information technology caused the application of digital technology to be increasingly common in work and life. At the same time, people have gradually realized that it is insufficient to master the technology itself, and they also must master the ability to understand, analyze, and utilize digital information. Therefore, the concept of digital literacy came into being. With the further development of society and the update and change of digital technology, the concept and connotation of digital literacy have been widely discussed and studied by relevant institutions and scholars in Yuan international <sup>[1]</sup>. The American Library Association interprets digital literacy as “the comprehensive ability to use information technology to process information” <sup>[2]</sup>. Wang further extended digital literacy to “teachers’ digital literacy refers to the awareness, ability, and responsibility of teachers to properly use digital technology to acquire, process, use, manage, and evaluate digital information and resources, discover, analyze, and solve education and teaching problems, and optimize, innovate, and change education and teaching activities <sup>[3]</sup>. Zhou, a scholar, added that digital literacy is a necessary survival skill for citizens in a digital society based on a digital society. It includes not only the ability to master the use of digital technology in work, study, and life, but also the ability to have emotions, attitudes, qualities, and values related to digital social life <sup>[4]</sup>.

In general, although the connotation of digital literacy is different, there is a common direction, that is, the emphasis on digital technology skills extends to many aspects. According to the key points of improving the digital literacy and skills of the entire population in 2022, digital literacy is defined as “the collection of a series of qualities and abilities such as digital acquisition, production, use, evaluation, interaction, sharing, innovation, security, and ethics that citizens in the digital society should possess in their study, work, and life.”

## **2.2. Connotation evolution of digital literacy**

The initial definition of digital literacy refers to the ability of individuals to use digital technology for basic operations, such as basic computer operations, file management, and network browsing. This is the basis of digital literacy and the premise of further development of digital technology capabilities. With the popularity of the Internet, people are faced with huge information resources, and information literacy has become an important part of digital literacy. Information literacy includes the ability of information acquisition, information evaluation, information processing, and information sharing, which helps people to filter, organize, and use effective information from massive information. The connotation of digital literacy is gradually enriched. Based on the current situation of digital literacy development at home and abroad, foreign countries started early, but since 2006, some scholars in China have conducted in-depth research on digital literacy (**Table 1**).

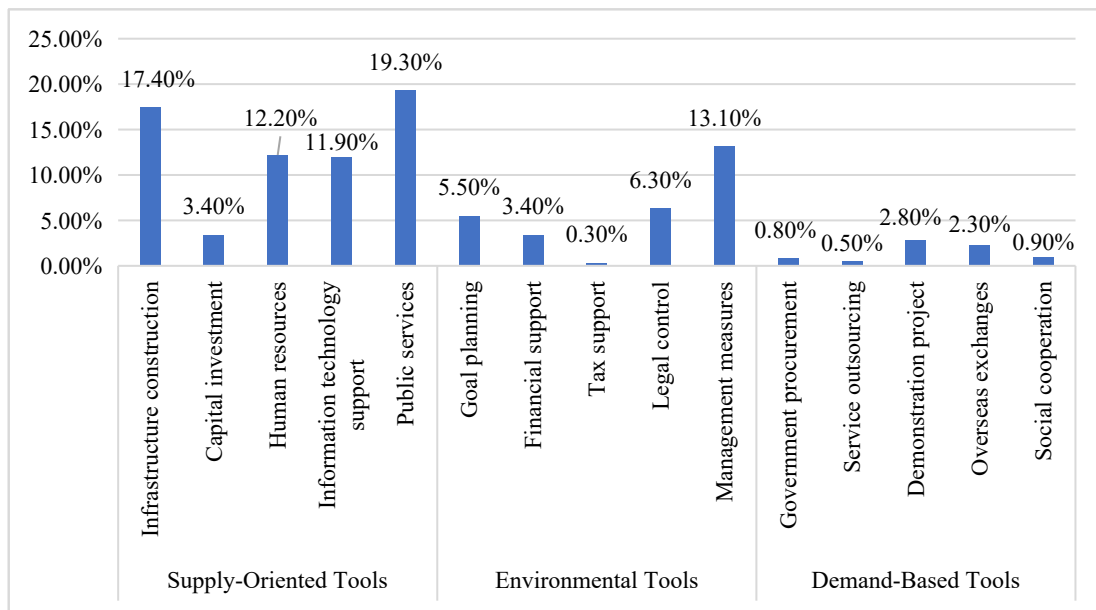
The connotation of digital literacy is constantly evolving and enriching. With the continuous development and application of digital technology, digital literacy also needs to keep pace with the times and adapt to new technologies and needs. At the same time, the cultivation of digital literacy also requires the joint efforts of education, society, and individuals to improve the digital quality and ability of the whole society.

**Table 1.** Connotation expression of digital literacy <sup>[4]</sup>

Area	Year	Institutions or individuals	Connotation
Overseas	1994	Israeli scholars (Yoram Eshet-Alkalai)	Ability to use or operate digital devices (software), a variety of complex cognitive, motor, sociological, and emotional skills. It mainly includes “picture-image literacy,” “re-creation literacy,” “branch literacy,” “information literacy,” and “social-emotional literacy.”
	1997	American scholar (Paul Gilster)	The ability to acquire, understand, and integrate digital information, including network search, hypertext reading, digital information criticism, and integration skills.
	2006	Polish scholars (Allan Martin)	The ability of individuals to carry out a series of activities with the help of digital devices, tools, and resources in a certain situation. It mainly includes the ability to identify, acquire, analyze, manage, integrate, evaluate, build new knowledge, innovate media expression, and communicate with others.
	2014	UK Joint Information Systems Committee (JISC)	The ability of individuals to survive, learn, and work in a digital society. It mainly includes media literacy, information literacy, digital scholarship, learning skills, communication and information technology literacy, career and identity management, and communication and collaboration capabilities.
	2014	American Association for Educational Communication and Technology (AECT)	The ability to search, find, organize, analyze, evaluate, and synthesize information, and use this information to communicate, manage, produce, and perform other tasks.
	2016	Organization for Economic Co-operation and Development (OECD)	To obtain all the exquisite abilities in all aspects of the workplace and social life, individuals need to understand all the technical potential, learn to use the ability, and have the critical spirit and judgment ability.
	2017	The International Federation of Library Associations and Institutions (IFLA)	Knowledge and technical skills needed to retrieve, understand, evaluate, create, and communicate digital information using information and communications technology (ICT)
	2017	European Union	It covers five major areas: information and data literacy, communication and collaboration, digital content creation, security assurance, and problem solving.
	2018	The United Nations Educational, Scientific and Cultural Organization (UNESCO)	The ability to securely and reasonably acquire, manage, understand, integrate, communicate, evaluate, and create information using digital devices and network technologies for employment, decent work, and entrepreneurship. It includes computer literacy, information and communication technology literacy, information literacy and media literacy.
	2023	American Library Association (ALA)	The ability to use information and communication technologies to find, evaluate, create, and exchange information, the cognitive and technical skills needed.
Domestic	2006	Hsiao Junhong	It includes not only technical skills, but also cognitive skills, emotional skills, and social skills.
	2012	Li Degang	The ability of using digital technology to cognize, criticize, and interact with digital content, multimedia language, and digital media in digital environment.
	2013	Wang Youmei, Yang Xiaolan, Hu Wei, <i>et al.</i>	Digital literacy is a comprehensive, dynamic, and open concept. It is formed through the evolution of media literacy, computer literacy, information literacy, and network literacy.
	2016	Shi Ge	Digital literacy is the continuation and deepening of information literacy, scientific literacy, and media literacy. It is the basic ability and attitude of modern citizens.
	2020	Sun Xuxin, Luo Yue, Li Shengtao	What people need to survive, work, learn, and develop in the digital society environment involves a comprehensive ability to understand, use, evaluate, and create digital technology in economic and social development. It mainly includes “technical operation,” “digital management,” “communication and sharing,” “collaborative learning,” “integrated creation,” “moral responsibility,” “diagnostic feedback,” and other basic elements.

### 3. Realistic dilemma of teachers' digital literacy cultivation in the era of digital intelligence

In the era of digital literacy, in addition to the lack of evaluation criteria, other problems are still widespread due to the improvement of standard release. There are still some practical difficulties on how to accurately evaluate and characterize teachers' digital literacy at the practical level [5]. In the analysis of the text content of China's digital literacy policy, Li *et al.* found that the use of policy tools in the dimension of digital citizenship literacy is not balanced, as shown in **Figure 1** [6].



**Figure 1.** Proportion of policy tools used

The improvement of digital literacy cannot directly bring significant economic benefits, resulting in a situation such that the government actively promotes digital literacy projects and provides sufficient human, material, and financial resources, but the social participation is low, and the project is currently heavily dependent on government funding.

#### 3.1. Lack of endogenous motivation and willingness to actively improve

Some teachers are not open enough to digital technology, and they lack interest and acceptance of new things. They may be more inclined to use traditional teaching methods, and are reluctant to try and apply digital technology tools and platforms. The main reason is lack of awareness. Some teachers may lack sufficient awareness of the importance of digital literacy and the impact of digital technology on teaching and education. They may think that traditional teaching methods are effective enough and there is no need to actively improve their digital literacy. Another reason is time pressure. Teachers' tasks are heavy, with the need to invest a lot of time and energy in preparing lessons, teaching, and correcting homework, etc., and they do not have enough time and energy to actively improve their digital literacy. Moreover, there is a lack of training opportunities. Some teachers may lack the necessary resources and training opportunities in digital technology. They may not know how to use digital tools to assist teaching, nor do they have enough support and guidance to improve their digital literacy.

### **3.2. Lack of external motivation and perfect cultivation mechanism**

Due to the low salary of teaching affairs and the difficulty of professional title evaluation, the participation and enthusiasm of teachers to participate in training and research need to be improved <sup>[7]</sup>. The lack of digital literacy assessment and reward mechanism, separation from professional title evaluation and performance appraisal, etc., will lead to some practical shackles in teacher training, and the quality of training needs to be improved. Through investigation and research, it is found that the gap between teachers' information-based teaching ability in rural areas and teachers in urban and rural-urban fringe areas through teacher training is increasing instead of decreasing <sup>[8]</sup>.

### **3.3. Lack of diversified and personalized settings in training program**

Firstly, the definition and connotation of digital literacy are different in different fields and populations. Each teacher's ability to learn and accept new knowledge is different, and the learning curve of digital technology also differs. Therefore, the cultivation of teachers' digital literacy requires tailored training and support programs to meet the needs of different teachers. Secondly, the update and change of digital technology is fast, and it is difficult to follow-up and update the content of the training system in time. In addition, the current digital literacy training system mainly focuses on the teaching of basic knowledge and skills, and lacks the cultivation of innovative thinking, information security, data analysis, and other aspects, which cannot meet the needs of the current society and working environment for digital literacy. In addition, the unbalanced distribution of training resources, the singleness of training methods, and the lack of standardization of training institutions also affect the effectiveness of the digital literacy training system.

## **4. Practical path of teachers' digital literacy cultivation in the era of digital intelligence**

### **4.1. Reconstructing the teacher knowledge system based on digital skills**

With the advent of the digital age, great changes are taking place in the field of education. Digital technology is gradually changing the way of teaching, learning, and classroom environment. Teachers need to have a high degree of learning awareness and constantly updated skills to adapt to the educational needs of the digital age, in order to provide students with a better educational experience and more diversified development space. From the perspective of the use of digital technology, teachers obviously do not update to the subject teaching synchronously, and the technical competence is insufficient. Digital transformation is a new concept of education and teaching. The development of teachers' digital ability requires them to build a new digital technology knowledge system to change the traditional thinking mode <sup>[9]</sup>. The first method is to achieve the transformation of knowledge structure through independent innovation and help the development of education ecosystem; the second method is to rely on the digital platform to promote subject teaching, timely reflect and improve, and fully tap the potential value of data, so as to promote teaching reform; the third method is to pay attention to the connection between digital education and industrial development, make use of the advantages of big data, gain insight into market demand, provide services accurately, and truly reflect the value of digital technology.

### **4.2. Improving teachers' digital literacy from the source based on national platform resources**

The following are methods to improve teachers' digital literacy based on national platform resources.

- (1) Establishing a sound training system: Through the national platform, carrying out digital literacy training for teachers, and covering the cultivation of basic knowledge, application skills, and

innovation ability, teachers can master the operation and application of digital technology, and it can be flexibly used in teaching practice.

- (2) Promoting the construction of digital teaching resources: Building a variety of digital teaching resources on the national platform, including teaching courseware, teaching video, educational games, etc., can provide teachers with rich teaching tools and materials to enhance their teaching effectiveness and innovation ability.
- (3) Establishing an interactive communication platform for teacher: Establishing an interactive communication platform for teacher on the national platform can provide opportunities for interaction, resource sharing, and experience learning among teachers, promote cooperation and learning among teachers, and jointly improve the level of digital literacy.
- (4) Strengthening policy support and incentive mechanism: The state should increase policy support for digital literacy training, encourage teachers to participate in digital literacy training and teaching innovation practice through incentive mechanism, and improve their enthusiasm and initiative.
- (5) Organizing expert evaluation and certification: Establishing an authoritative digital literacy assessment system and inviting experts for the evaluation and certification of trained teachers.

### **4.3. Ensuring the output of teachers' digital literacy results through parallel evaluation and research training**

Establishing a scientific evaluation mechanism can play a better role in improving teachers' digital literacy<sup>[10]</sup>. The essential role of evaluation is to formulate clear evaluation criteria, including teachers' basic ability requirements, professional knowledge, and practical skills in the application of digital technology. The evaluation criteria should be specific and detailed, which can quantitatively evaluate the digital literacy level of teachers. The design of research and training courses should be optimized by carrying out special research and training courses for teachers' digital literacy training needs. The training course should combine the actual needs of teachers, provide practical teaching cases and practical operation guidance, and help teachers to achieve substantive results in the application of digital technology. Moreover, evaluation and research training should be implemented in parallel. Evaluation and research training should cooperate with each other to form a closed-loop mechanism. In the process of research and training, teachers can regularly evaluate their learning results, discover problems in time, and carry out targeted counseling and training to ensure that teachers can timely digest and absorb the knowledge they have learned and apply it to practical teaching. Support and feedback mechanisms should be provided. A teacher learning support and feedback mechanism should be established to provide teachers with relevant learning resources and guidance, and timely feedback on learning outcomes and problems. Through regular communication and communication, teachers are encouraged to share their learning experience.

### **4.4. Promoting the construction of digital transformation ecosystem and improving teachers' digital literacy at multiple levels**

Teachers' digital literacy can be improved at multiple levels, as follows.

#### **(1) Social level**

The government is encouraged to introduce policies to support the digital transformation of teachers, such as providing financial support, training resources, etc. The cooperation between education and enterprises is strengthened to establish internships, training, and other channels, so that teachers can understand the latest developments in the industry and improve their digital literacy. The open sharing of digital educational resources is expanded to provide more teaching tools, platforms, and courses, so that teachers can make better use of digital technology for teaching.

(2) School level

A digital transformation development plan is formulated, and the digital goals and directions of the school are clarified. The construction of teaching staff is strengthened by training and selecting teachers with digital literacy through relevant training and support. Advanced digital education equipment and platform are provided, so that teachers can have the conditions and opportunities to carry out digital teaching practice.

(3) Teacher level

Teachers should take part in training and professional development courses. Teachers can participate in digital literacy training courses or seminars to learn the latest technologies and educational methods. These trainings can help teachers to understand how to effectively use the digital tools and resources to support students' learning. Furthermore, teachers can participate in educational communities or online platforms to communicate and share experiences with other teachers. In this way, we can learn from each other and get practical.

## Disclosure statement

The author declares no conflict of interest.

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