

# Current Situation and Improvement Path of Digital Literacy of College Teachers Under the Background of Educational Digitization

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**Abstract.** The advent of the digital age has caused profound changes in the field of education. The digitization of education has become an inevitable trend, and hence the promotion of digital literacy among teachers is an essential requirement for strengthening the digitization of education. This study aimed to construct a digital literacy index system for college teachers, including five dimensions: digital knowledge, digital technology use, digital information management, digital problem-solving literacy and digital security. A questionnaire survey was conducted to understand the current level of digital literacy among college teachers, their current deficiencies were analyzed, and reasonable suggestions for the digital literacy path of college teachers were provided.

**Keywords.** Digital literacy of university teachers; digital transformation of higher education; education digitization

## 1. Introduction

Today's society is in an era of significant changes in digital transformation. As modern information technologies, such as artificial intelligence, Big Data analysis, mobile learning, and blockchain, are being integrated more into the field of education and teaching [1], the digital transformation and upgrading of education have been further promoted, and the digitalization of education has become a key issue of global concern. Digital transformation of higher education is the future trend of higher education development. It is also an important measure to realize lifelong education for all. In recent years, strategic actions on education digitalization have been launched worldwide, emphasizing "constantly improving teachers' awareness and ability to use digital technology to improve education and teaching" [2]. Digital literacy has become essential for citizens in the digital era. It is of great significance to study the current situation of digital literacy of teachers and strategies to improve it. This study aimed to construct a digital literacy index system for investigating the current situation of digital literacy among college teachers, identify the problems existing in the digital literacy of teachers, and provide policy basis for the construction of a digital literacy index system of teachers.

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## **2. Construction and connotation of the digital literacy index system for college teachers**

### *2.1 Construction of the digital literacy index system for teachers*

Digital literacy was first proposed by Israeli scholar Yoram in 1994. The connotation of digital literacy has integrated various kinds of literacy, such as computers, networks, and media, due to the deepening of research in this field [3]. The digital literacy of teachers is an essential factor in promoting the digital transformation of higher education, and the construction of a digital literacy index system for teachers is a prerequisite for strengthening their digital literacy. This study was based on Teachers' Digital Literacy issued by the Ministry of Education, combining and analyzing domestic and foreign literature on digital literacy indicators of teachers (Table 1) and comprehensively considering the characteristics of university teachers' work. Five dimensions of digital knowledge, digital technology use, digital information management, digital problem-solving literacy, and digital security were selected as the first-level indicators for assessing the digital literacy of teachers. Eighteen second-level indicators were included under these five dimensions.

### *2.2 Connotation of the digital literacy index system for teachers*

Digital literacy of teachers means that teachers can effectively obtain digital information resources; communicate and collaborate with digital tools; quickly search, extract, and analyze data; and store and ensure data security. In this study, the digital literacy evaluation index system for college teachers included five dimensions: digital knowledge literacy, digital technology application literacy, digital information management literacy, digital problem-solving literacy, and digital security literacy. Its connotations are as follows:

- (1) Digital knowledge literacy index refers to cognitive literacy among teachers on the development of digital information and technology. For example, the understanding of the latest digital information, developing Big Data, artificial intelligence, and other digital knowledge in different fields.
- (2) Digital technology application literacy refers to the ability of teachers to use digital offices to meet teaching and social needs. It requires teachers to fully use digital tools for communication and collaboration.
- (3) Digital information management literacy refers to the ability of teachers to conduct digital retrieval, evaluation, organization, and sharing.
- (4) Digital problem-solving literacy refers to the ability of teachers to creatively solve problems using digital technology under the guidance of digital consciousness combined with the active application of knowledge.
- (5) Digital security literacy refers to the ability of teachers in data privacy, security protection, and other aspects.

Table 1. Main sources of the digital literacy index system

Sources	Indicator dimensions	Indicator description
The New Media Alliance (New Media Consortium, NMC) [4]	1. General literacy 2. Innovation literacy 3. Interdisciplinary literacy	1. Proficiency in basic digital office software tools 2. Use of digital skills to solve work problems creatively 3. Understanding of digital knowledge across different disciplines
The Digital Competence Framework [5]	1. Information field 2. Field of communication 3. Security area 4. Problem-solving domain	1. Get the knowledge you need quickly filter information from digital new 2. Use of technology-enabled communication, collaboration, and sharing of information content 3. Knowledge of good digital network environment and privacy and protection of personal data security 4. Use of digital technology to solve problems creatively and determine appropriate technical countermeasures according to individual needs
The UK Essential Digital Skills Framework [6]	1. Communicating 2. Handling information and content 3. Transacting 4. Problem solving 5. Being safe and legal online	1. Use of media tools to interact, share, and publish information on social media 2. Ability to screen, identify, and process online information content, and use of search engines to browse and find information 3. Use of the Internet to book all kinds of goods 4. Use of the Internet to find information that can help solve a problem, and then analyze the actual problem 5. Use of the Internet legally and protecting one's own privacy
Yang Shuang, Zhou Zhiqiang [7]	1. Digital technology use 2. Digital Information management 3. Digital content creation 4. Digital community building 5. Digital security capabilities	1. Use of digital office software and teaching software 2. Ability to retrieve, evaluate, organize, and share information 3. Use of digital technology to create teaching and office content 4. Use of digital technology to communicate and collaborate with others 5. Ability to identify oneself as a digital citizen and to protect one's own privacy during information sharing
Li Qing, Zhao Huanhuan [8]	1. Data knowledge 2. Data skills 3. Teaching applications 4. Moral awareness	1. Basic knowledge of data and data tools 2. Ability of data acquisition, management, analysis, and evaluation 3. Knowledge of data exploration and communication, and ability to solve teaching problems 4. Knowledge of data ethics awareness

3. Survey on the current situation of digital literacy of college teacher

Universities have put forward higher requirements for digital literacy of teachers with the deepening of digital technology in the field of education and teaching. On the one hand, the evaluation of digital literacy among college teachers can help colleges and universities to identify the problems existing in the digital literacy of teachers and

strengthen it. On the other hand, it also provides practical directions for teachers to improve their own digital literacy. Through empirical investigation of the digital literacy of college teachers, this study evaluated the overall level of digital literacy of college teachers and provided reasonable suggestions for improving the digital literacy of college teachers.

*3.1 Average score of the first-level index of digital literacy of college teachers*

After determining the 5 index systems, 300 college teachers in Xiangnan University were included as research objects, and the current situation of the digital literacy of college teachers was investigated. A total of 300 questionnaires were sent out, and 285 valid questionnaires were recovered.

Based on the comprehensive fuzzy evaluation method, this study designed a questionnaire survey on the digital literacy of college teachers. A 5-level Likert scale was used, with each item having five different options: complete agreement, relative agreement, general agreement, relatively inconsistent, and completely inconsistent. Scores of 100 points, 80 points, 60 points, 40 points, and 20 points were assigned to the participants who selected complete conformity, relative conformity, general conformity, relative nonconformity, and complete nonconformity, respectively, to test the scores of college teachers in the aforementioned five dimensions. The average scores of the evaluation according to the questionnaire survey results are presented in Table 2.

**Table 2.** Average scores of the first-level index of digital literacy of college teachers

No.	Primary index	Average assessment score (points)
1	Digital knowledge	74.43
2	Digital technology application	87.37
3	Digital information management	82.11
4	Digital problem solving	72.28
5	Digital security	86.31

Through the comprehensive fuzzy evaluation method, the evaluation scores of college teachers in the first-level indicators were realized, and these scores reflected the overall level of digital literacy of college teachers. This study provided a basis for realizing the overall goal of digital literacy for college teachers by analyzing the advantages and disadvantages of digital literacy.

As shown in Table 2, the three first-level indicators of teacher literacy, namely, the use of digital technology, digital information management, and digital security, had a score of more than 80 points, indicating that college teachers had a high level of literacy in these aspects. From the average of these five indicators, the score of digital technology use ranked first, with 87.37 points, which indicated that college teachers had a strong ability of using digital technology and had some basic digital skills. Digital security ranked second, with 86.31 points, indicating that the awareness of digital security use of college teachers was gradually enhanced, and the teachers could ensure digital security to some extent. Digital information management ranked third, with 82.11 points, indicating that colleges and universities had a certain ability to manage digital information. Digital knowledge ranked fourth, with a score of 74.43. Also, the digital

knowledge literacy level of college teachers was far less than the digital technology ability literacy, and the application level of digital technology was obviously better than the digital knowledge literacy level. The understanding of digital information knowledge of college teachers in different disciplines was still weak, and their cognitive level of digital theory needed improvement. The teachers could effectively use digital technology to carry out teaching only by mastering more basic knowledge about digital technology. The score of digital problem-solving literacy was the lowest, 72.28 points, indicating that digital problem solving was the weakest link in the literacy of college teachers, and digital problem-solving literacy needed urgent improvement.

3.2 Status quo of digital literacy of college teachers

Next, this study aimed to understand the current situation of the overall level of digital literacy of college teachers in each digital secondary index. Therefore, 5 points, 4 points, 3 points, 2 points, and 1 point were assigned to complete conformity, relative conformity, general conformity, relative nonconformity, and complete nonconformity, respectively, in the questionnaire survey. According to the scoring characteristics of Likert's 5-level scale, two items, relatively consistent and completely consistent, were assessed. That is, when 85% of the respondents' answer score in a category was greater than or equal to 4 points, the majority of teachers were considered to have a higher level of literacy in that category. When the proportion of teachers meeting or fully meeting the requirements in one category was less than 70%, the majority of teachers were considered to have a low level of that quality, and the level in this quality needed improvement.

In the survey on the current situation of digital literacy of college teachers, among the 18 digital literacy assessment items of college teachers, 6 items showed that more than 85% of teachers had relatively consistent and fully consistent choices. This indicated that the teachers had a high level of digital literacy in technology application, collaborative communication, information collection, and privacy protection.

(1) Evaluation results of the secondary index of digital knowledge literacy

Table 3. Secondary index of digital knowledge literacy evaluation scale

Item	Digital knowledge secondary index	Percentage of score $\geq 4$
1	I can quickly get the latest knowledge from different media.	77.19%
2	I accept digital information at work and process it quickly.	73.68%
3	I am familiar with the development of Big Data, artificial intelligence, blockchain, cloud computing, and other digital technologies and understand their impact.	68.77%
4	I have an understanding of digital knowledge in different fields.	66.31%

According to the digital knowledge literacy evaluation scale in Table 3, the cognition of digital knowledge of college teachers was poor, especially in the cognition of digital literacy. Further, 31.23% of the respondents said they were not familiar with the development status and influence of digital technologies such as Big Data, artificial intelligence, blockchain, and cloud computing. Moreover, only 66.31% of the respondents said they had some understanding of digital knowledge in different fields, so this category also needed to be strengthened in digital knowledge domain literacy. Digital knowledge is the basis for teachers to use digital technology for education and

teaching. However, according to the survey results, the digital knowledge literacy of college teachers needed great improvement.

(2) Evaluation results of secondary indicators of digital technology application

**Table 4.** Digital technology application literacy evaluation scale of secondary indicators

Item	Secondary indicators	Percentage of score $\geq 4$
5	I can skillfully use digital teaching software to complete teaching tasks.	88.42%
6	I am able to communicate formally with colleagues, students, or others via email.	91.22%
7	I am able to post appropriate information via social media.	89.47%

As shown in Table 4, college teachers had a strong ability of digital technology applications. Compared with digital knowledge literacy, the current situation of the application level of digital technology of teachers was better than that of digital knowledge. In the digital technology literacy assessment, the ability to communicate and cooperate with others through digital technology was the best, indicating that college teachers could effectively coordinate and communicate through digital technology and complete teaching tasks through digital technology applications.

(3) Evaluation results of the secondary index of digital information management

**Table 5.** Secondary index of digital information management literacy assessment scale

Item	Secondary indicators	Percentage of score $\geq 4$
8	I can quickly and accurately use the Internet and other platforms to search for the information I need.	87.72%
9	I am able to judge the authenticity and reliability of the information I receive.	80.7%
10	I am able to assess the value of the information gained and its relevance to the job.	84.21%
11	I am able to organize, analyze, and store the information I receive effectively.	78.95%

As shown in Table 5, the digital information management literacy of teachers was at a medium level, and most teachers performed well in using the Internet and other platforms to quickly and accurately search for the required information. However, some gaps still existed in digital information analysis and identification, and only 78.95% of the teachers said they could effectively organize, analyze, and store the acquired information. The survey results showed that college teachers had good evaluation ability in the dimension of information search and could find the teaching digital resources needed in education and teaching, but their ability to distinguish the authenticity of digital information was poor. In the future training, it is necessary to enhance their literacy in this aspect.

(4) Evaluation results of the secondary index of digital problem-solving ability literacy

**Table 6.** Secondary index of digital problem-solving literacy evaluation scale

Item	Secondary indicators	Percentage of score $\geq 4$
12	I have good data thinking, knowledge, and skills.	71.93%
13	I am able to use digital technologies and platforms for continuous learning.	80.7%
14	I can create digital content of higher standard according to work or study requirements.	76.49%
15	I am able and willing to use digital technology to solve problems creatively.	75.44%

In the scale, question 12 represented digital awareness, question 13 represented digital learning, and questions 14 and 15 pointed to digital reshaping problems and innovation, respectively. As shown in Table 6, the level of digital awareness and literacy of college teachers was not ideal. Only 71.93% of teachers thought they had good data thinking, knowledge, and skills.

The performance of digital creation and digital innovation literacy was not so good, which also showed that the digital innovation ability of college teachers was insufficient, especially in using digital technology to solve problems creatively. In future training, colleges and universities should pay attention to the digital thinking habits of teachers and their ability to use digital technology to create information.

(5) Evaluation results of secondary index of digital security

**Table 7.** Secondary index of digital security ability literacy evaluation scale

Item	Secondary indicators	Percentage of score $\geq 4$
16	I am able to protect the data and information generated by my work or study to a certain extent.	85.26%
17	I can regulate my behavior in the network environment with the quality of a network citizen.	87.72%
18	I am able to protect my privacy during the information-sharing process.	80%

Table 7 shows that 87.72% of the teachers surveyed believed they could protect the data and information generated in their work or study to a certain extent. This indicated that teachers had a high level of data security literacy, but still lacked the ability to protect their privacy and security in information sharing. According to the survey results, the awareness and ability of college teachers to research, judge, and prevent digital risks needed to be improved.

**4. Conclusions**

The survey results of the current situation of digital literacy of college teachers showed that college teachers had good literacy in the application of digital technology, digital security, and digital information management, especially in the use of digital tools for communication and cooperation, but they had poor literacy in digital knowledge and digital problem solving.

Education worldwide is showing a trend of digitalization. The demand for digital transformation of higher education has led to an improved ability of digital literacy in colleges and universities. The improvement in the digital literacy of teachers is of paramount significance to the transformation of higher education. Based on the existing problems of the digital literacy of college teachers, this study put forward suggestions to improve the digital literacy of college teachers from four aspects: top-level design, digital consciousness stimulation, digital literacy training system improvement, and system guarantee construction.

#### *4.1 Comprehensively promote the improvement in digital literacy of teachers*

The improvement in digital literacy of university teachers is a huge systematic project, which not only is a matter of individual teachers but also involves many subjects such as society, government, and universities. The improvement in the digital literacy of college teachers requires the coordinated promotion of various aspects led by the government and universities. In particular, it is necessary to do a good job in top-level design, implement top-down reforms, promote the improvement in the digital literacy of teachers as a key task, combine the current situation of the digital literacy of college teachers, formulate an overall strategy for the improvement of digital literacy of college teachers, and use digitalization as a lever to empower teachers. Therefore, coordination and promotion of the construction of digital literacy of college teachers is essential.

#### *4.2 Focus on stimulating the awareness of digital literacy of teachers*

The current situation shows that the digital knowledge literacy of teachers is still relatively weak, their digital thinking has big problems, and their digital literacy awareness is weak, indicating a big gap with the requirements of education digitalization. The first thing that needs to be done to solve this problem is to improve the awareness of digital literacy of teachers. College teachers should change their teaching ideas, thoroughly implement the idea of “educating people by first educating themselves”, effectively improving their information literacy, improving their ability to use information technology, and integrating information technology, including artificial intelligence, into course content, teaching methods, and evaluation system. They should promote the construction of a high-quality education system. At the same time, digital technology should be integrated into the teaching in classroom education of related disciplines to form a good concept of interdisciplinary literacy.

#### *4.3 Improve the digital literacy training system for college teachers*

The current situation reveals that, although teachers can use a variety of digital technologies, they lack digital knowledge, information discrimination, and digital problem-solving literacy. These problems can be solved through effective training. The traditional training mode and the content are simple, which cannot meet the requirements of the digitalization of education for teachers in the new era. Therefore, it is necessary to improve the digital literacy training system of college teachers, focus on improving the ability of teachers to solve education and teaching problems using digital problems and pay attention to the training of technical cognition of college teachers so as to deepen their understanding of new technologies and their cognition of development trends. Attention should be paid to the cultivation of digital innovative thinking of college



teachers and help them establish an excellent interdisciplinary knowledge framework system.

#### *4.4 Improve the digital literacy mechanism of teachers*

The current situation indicates that the consciousness of college teachers in solving digital problems is weak, which is related to the incomplete guarantee mechanism of their digital literacy. The phenomenon of attaching importance to scientific research and neglecting teaching in colleges and universities leads to the unwillingness of teachers to study teaching. The reason lies in the management of the school system. To effectively promote the improvement in digital literacy of college teachers and encourage them to actively and consciously improve digital literacy, the colleges and universities need to formulate corresponding guarantee mechanisms, such as linking digital teaching achievements with professional title evaluation and related teaching awards, increasing support for the construction of digital talents, and providing a good system and environmental guarantee for the digital literacy of college teachers. The digital literacy system and mechanism of college teachers should be improved, and the internal driving force of improving digital literacy of college teachers should be fully stimulated.

This study included 285 teachers from Xiangnan University as research objects to evaluate the digital literacy level of college teachers. However, the sample size was too small. The indicator system of the digital literacy of teachers in this study should be further improved, the sample size should be expanded, and the scope of research results should be extended, so as to make significant contributions to the improvement in digital literacy of college teachers.

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