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Original Paper

Evaluating Digital Literacy in Higher Education: Empirical Evidence from Sichuan Province, China

Qing He

Department of Construction Engineering Management, Southwest Jiaotong University Hope College, Chengdu, Sichuan, China 610400

E-mail: 871699063@qq.com

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Abstract

The digital literacy of higher education teachers has become a key factor affecting the quality of education. In 2022, China's Ministry of Education released an standard for teachers' digital literacy (TDL). Therefore, this study conducted a questionnaire survey based on the TDL, and empirically analyzed the digital literacy of 271 higher education teachers in Sichuan Province, China. The results indicate that the digital literacy of higher education teachers generally falls within a moderate level, exhibiting high scores in digital awareness and digital social responsibility, yet necessitating enhancement in digital application and professional development. It was further found that factors such as age and professional title significantly influence teachers' digital literacy, whereas the gender difference in digital literacy is not pronounced. Moreover, recommendations for enhancing digital literacy have been outlined to foster the development of teachers' digital literacy.

Keywords

Digital literacy, Higher education teachers, Professional development

1. Introduction

Digital technology has emerged as a significant driver for reform and advancement across diverse industries. In the current educational environment, technology has penetrated into every aspect of education, and a range of education systems require digital education platforms or assessment tools for learning and teaching (Porat et al., 2018). Digital literacy is recognized as a crucial competency for teachers to meet evolving demands. Teachers, as front-line educators, are encountering shifts not only in teaching methodologies but also in educational environment and student profiles. Hence, enhancing teachers' digital literacy is imperative to address the evolving educational needs in the digital era.

The concept of digital literacy was first introduced by Paul Gilster in 1997, who defined it as "the ability to properly use and evaluate digital resources, tools, and services, and apply it to lifelong learning processes" (Gilster P., 1997). In the field of teacher digital literacy, many countries or institutions have sequentially proposed teacher digital literacy frameworks, such as the "Digital Competence Framework for Educators (DigCompEdu)" by the European Commission (European Commission, 2013), UNESCO's the "Information and Communication Technology (ICT) Competency Framework for teachers" (UNESCO,2011), and "the Common Framework for Digital Competence for Teachers" designed by the Spanish Ministry of Education, Culture and Sport in 2012. Besides, many scholars have conducted empirical studies on the digital literacy of diverse categories of teachers, such as EFL teachers (Feng & Sumettikoon, 2024), pre-service teachers (Hairida et al.,2023), foreign language teachers (Huang F., 2024).

In 2022, China's Ministry of Education introduced industry standards for teachers' digital literacy (TDL), outlining a teacher digital literacy framework from five dimensions: digital awareness, digital technology knowledge and skills, digital application, digital social responsibility, and professional development (Ministry of Education of the People's Republic of China, 2022). These standards provide a crucial foundation for researching and evaluating teachers' digital literacy in China. Therefore, this study employed a quantitative method using a five-point Likert questionnaire designed based on TDL to assess the current status of teachers' digital literacy in higher education in China. Furthermore, gender, age, and professional title differences were thoroughly explored to suggest strategies for enhancing digital literacy.

2. Research Data and Methodology

2.1 Measurement Instrument

The questionnaire draws its primary content from the TDL standards, which clearly outline the teacher digital literacy framework including digital awareness, digital technology knowledge and skills, digital application, digital social responsibility, and professional development. Specifically, digital awareness reflects teachers' comprehension of the importance and challenges within digital education. The digital technology knowledge and skills dimension assesses fundamental proficiency in using digital tools. The digital application dimension focuses on how teachers integrate digital technology into their teaching practices. Digital social responsibility emphasizes teachers' consciousness regarding information security and ethical standards in the digital environment. Professional development indicates the willingness and ability to use digital technology for ongoing learning.

The questionnaire comprises 35 questions and is divided into three parts: teachers' personal information, digital literacy level and digital support within the university setting. Specifically, personal information consists of 7 questions regarding gender, age, education, professional title, teaching experience. Digital literacy level is mainly examined through the aforementioned five dimensions, comprising a total of 24 questions. The final section includes 4 questions aimed at evaluating the quality of the digital

environment and support offered by the institution, including aspects like digital facilities and training provisions.

Except personal information, the questionnaire uses a five-point Likert scale with levels ranging from "strongly disagree" to "strongly agree," each assigned a score between 1 and 5. This implies that a higher score reflects a higher level of digital literacy. The reliability of the measurement depends on the stability and consistency of the measurement results (Carmines & Zeller, 1979). In this study, the questionnaire's reliability was evaluated using Cronbach's Alpha, a widely recognized metric for assessing reliability. The questionnaire's overall Cronbach's Alpha coefficient was computed at 0.87, exceeding the benchmark of 0.7, signaling substantial internal consistency. Further analyses demonstrated that the Cronbach's Alpha coefficients for the five sub-dimensions ranged between 0.81 and 0.92, fulfilling the predefined reliability criteria.

2.2 Sample Characteristics

The questionnaire survey was conducted in Chengdu, Sichuan Province, China, with participants being exclusively higher education teachers.. The questionnaires were distributed anonymously via an online platform, resulting in a total of 306 responses received. After removing invalid responses, 271 valid responses remained, indicating the sample size for this study. Table 1 shows the sample profile of this study. Female teachers comprised 65.7% of the sample group. In term of age distribution, approximately 80% of teachers were under 45 years old. Lecturers constituted the majority at 67.5%, followed by teaching assistants at 17%, and teachers with the title of associate professor or higher at 15.5%.

Table 1. Sample Profile

Factor	Categories	Frequencies	Percentage
Gender	Male	93	34.3%
	Female	178	65.7%
Age	Less than 35	103	39.1%
	35-45	109	39.1%
	45-55	39	14.4%
	55 or above	20	7.4%
Years of Teaching	Less than 5	110	40.6%
	5-10	95	35.1%
	10-15	52	19.2%
	15 or above	14	5.2%
Professional Title	Teaching assistant	46	17.0%
	Lecturer	183	67.5%
	Associate professor or above	42	15.5%

Type of Institution	Public	131	48.3%
	Private	140	51.7%

3. Results and Discussions

3.1 Overall Digital Literacy Analysis

Table 2 presents the overall level of digital literacy among higher education teachers in Sichuan Province, China. The statistical analysis of the questionnaire reveals that the average digital literacy score is 3.78 out of 5.

Among the specific dimensions, digital awareness and digital social responsibility performed exceptionally well, scoring an average of 4.91 and 4.41 respectively. This suggests that the teachers generally have a good understanding of digital concepts, and acknowledge the importance of digital technology in education. They demonstrate a conscious adherence to internet laws and regulations and prioritize data security and privacy. The lower standard deviation (0.18/0.17) indicates a high level of internal consistency among the surveyed teachers.

Conversely, the dimension of digital application received the lowest average score of 2.94, with scores ranging from 1.67 to 3.67, with a higher standard deviation and a higher standard deviation, highlighting weaknesses and variations in teachers' application abilities. Similarly, professional development also scored relatively low with a mean of 3.19, indicating a weaker aspect of teachers' digital literacy. The dimension of digital technology knowledge and skills obtained an average score of 3.44, with a range from 2.33 to 4.33. This suggests a moderate level of knowledge and skills mastery among teachers, with significant variability.

Table 2. Overall Digital Literacy Analysis (n=271)

Dimension	Mean	Min	Max	SD
Digital awareness	4.91	4.00	5.00	0.18
Digital technology knowledge and skills	3.44	2.33	4.33	0.50
Digital application	2.94	1.67	3.67	0.68
Digital social responsibility	4.41	4.00	4.75	0.17
Professional development	3.19	1.67	3.67	0.52
Overall	3.78	3.00	4.23	0.27

3.2 Age difference Analysis

This study adopts one-way ANOVA and post hoc multiple comparison test methods, in order to examine the differences in digital literacy levels across age groups. The results are summarized in Table 3.

The analysis indicates significant differences in digital literacy among various age groups, with an F-value of 129.96 and $p < 0.05$. The Student-Newman-Keuls (S-N-K) method was then employed to

deeply explore the differences between the four age groups. It was found that the teachers under 45 years old scored significantly higher than those over 45 years old, indicating superior digital literacy level among younger teachers.

When evaluating across the five dimensions, all dimensions except digital social responsibility displayed significant differences in scores among different age groups ($p<0.05$). To be specific, the teachers under 35 excelled in digital awareness and digital technology knowledge and skills, while teachers aged 35-45 performed better in digital application and professional development. This superior performance among younger teachers may stem from their enhanced adaptability and ability to learn from new technologies. In summary, the findings show that age is an important factor influencing teachers' digital literacy level, and with the increase of age, the level of digital literacy presents a certain degree of decline.

Table 3. Age Difference Analysis

Dimension	≤35 n=103 M(SD)	35-45 n=109 M(SD)	45-55 n=39 M(SD)	≥55 n=20 M(SD)	F	Sig.	S-N-K Result
Digital awareness	4.98(0.02)	4.97(0.06)	4.71(0.13)	4.48(0.26)	246.3	0.00	(1),(2)＞(3)＞(4)
Digital technology knowledge and skills	3.90(0.26)	3.23(0.31)	3.15(0.28)	2.58(0.21)	190.4	0.00	(1)＞(3),(2)＞(4)
Digital application	2.72(0.79)	3.32(0.48)	2.84(0.32)	2.33(0.32)	25.9	0.00	(2)＞(3),(1)＞(4)
Digital social responsibility	4.41(0.18)	4.43(0.16)	4.40(0.17)	4.33(0.16)	2.0	0.11	Not significant
Professional development	3.38(0.33)	3.43(0.28)	2.56(0.22)	2.15(0.44)	163.7	0.00	(2),(1)＞(3)＞(4)
Overall	3.88(0.25)	3.88(0.09)	3.53(0.07)	3.18(0.15)	129.9	0.00	(1),(2)＞(3)＞(4)

Note. a) Statistical significance was determined at $\alpha= 0.05$. b) The symbols (1), (2), (3), and (4) in the S-N-K Result column represent the age group ≤35, 35-45, 45-55, and ≥55 years, respectively.

3.3 Analysis of Differences in Professional Titles

One-way ANOVA and post hoc multiple comparison test methods were also employed to explore whether professional title plays an important role in determining teachers' digital literacy levels. The findings from Table 4 show that the F-value is 81.7, with $p < 0.05$, signifying a significant impact of professional titles. Among the three professional titles, lectures present the highest level of digital literacy, followed by teaching assistants, and lastly, associate professor or above.

As can be seen from the S-N-K results, lectures score higher in digital application and professional development, while teachers with titles of associate professor or above, score lower in some

dimensions. This contrast in performance could potentially be linked to the heavier workload associated with higher professional titles, the career development stage, and varying levels of acceptance towards digital technologies.

Table 4. Analysis of Differences in Professional Titles

Dimension	(1) n=46 M(SD)	(2) n=183 M(SD)	(3) n=42 M(SD)	F	Sig.	S-N-K Result
Digital awareness	4.98(0.02)	4.95(0.11)	4.65(0.28)	89.2	0.000	(1)＞(2)＞(3)
Digital technology knowledge and skills	3.78(0.29)	3.44(0.48)	3.02(0.42)	31.7	0.000	(1)＞(2)＞(3)
Digital application	2.01(0.48)	3.19(0.50)	2.88(0.63)	94.5	0.000	(2)＞(3)＞(1)
Digital social responsibility	4.38(0.20)	4.42(0.17)	4.39(0.16)	0.97	0.381	Not significant
Professional development	3.00(0.26)	3.44(0.35)	2.33(0.39)	212.0	0.000	(2)＞(1)＞(3)
Overall	3.64(0.14)	3.89(0.21)	3.45(0.29)	81.7	0.000	(2)＞(1)＞(3)

Note. a) Statistical significance was determined at α= 0.05. b) The symbols (1), (2) and (3) represent the group of teaching assistants, lectures, associate professor or above respectively.

3.4 Gender difference Analysis

This study also investigated potential gender differences in digital literacy by using independent samples t-Test method. The results reveal no substantial differences in digital literacy between male and female participants, as evidenced by a p-value of 0.765, which exceeds the significance threshold of 0.05. This absence of significant distinctions implies that, within the scope of this study, gender might not be a major factor influencing digital literacy levels. Nevertheless, upon more detailed analysis, it was observed that male teachers scored significantly higher than their female counterparts solely in the dimension of digital social responsibility. This particular finding suggests a potential necessity for gender-specific training to enhance digital social responsibility among educators.

3.5 Digital Environment in Different Institutions

In the questionnaire, this study also investigated the digital environment in teachers' institutions, such as digital teaching and learning space, hardware facilities, availability of digital resources, and provision of relevant training. Employing a five-point Likert scale, higher scores denoted a superior digital environment and stronger support for the teachers.

The investigation unveiled that the overall digital environment within institutions is poorly developed, registering a mean value of 2.42. To further examine the contrast in digital environment between public and private institutions, an independent sample t-test was conducted. The results, as shown in Table 6, illustrate that the mean score in public institutions is higher than that of private institutions, with a

statistically significant difference ($p < 0.05$). This suggests that public institutions may have more comprehensive facilities and equipment, thereby providing teachers with a richer array of digital resources and more structured training opportunities to enhance their digital literacy levels. Furthermore, the standard deviation values within private institutions slightly exceed those of public institution, reflecting variations in the digital environment across private institutions.

Table 5. Analysis of Digital Environment Construction in Different Universities

Type	Mean	SD	t-value	df	Sig.
Public	2.94	0.28	22.22	269	0.000
Private	1.94	0.43			

4. Conclusions and Recommendations

4.1 Research Conclusions

By analyzing the research data on the digital literacy of higher education teachers in Sichuan Province, China, this study obtained the following main conclusions. The overall digital literacy of higher education teachers is at an intermediate level. Despite better performance in digital awareness and digital social responsibility, notable shortcomings persist in digital application and professional development. This indicates that while higher education teachers acknowledge the significance of digital technology, they encounter challenges in effectively applying it due to a lack of requisite knowledge and practical skills.

Further exploration reveals that gender displayed no significant impact on digital literacy levels. However, age and professional title proved to be influential factors, with younger and middle-aged teachers scoring higher across most dimensions. Also, there are deficiencies in digital environment construction, indicating a lack of robust support for teachers.

5. Recommendations

Drawing from the results of the aforementioned analysis, this paper puts forward the digital literacy enhancement recommendations for higher education teachers from three aspects: digital literacy evaluation system, digital technology knowledge and application ability, and digital environment construction.

5.1 Digital Literacy Evaluation System

Enhancing teachers' digital literacy requires a structured assessment of their proficiency levels. Establishing a coherent evaluation framework can empower educators to discern their strengths and weakness. Meanwhile, universities can leverage the evaluation model for sustained monitoring and the formulation of targeted training plans. Therefore, university administration should develop evaluation scales and test repository. To ensure evaluation objectivity, methods like self-assessment, peer

evaluation, and expert evaluation should be integrated. Also, the university administration should be responsible for data analysis and providing teachers with actionable development suggestions.

5.2 Digital Technology Knowledge and Application Ability

Acquiring proficiency in digital technology knowledge and application is a critical component for teachers to execute digital teaching methodologies. Research findings show that higher education teachers are struggling to integrate digital tools into their teaching practices because of sill gaps. Hence, a tiered training framework tailored to varying levels of digital literacy should be established. For example, foundational courses focus on the theoretical knowledge and hands-on practical training, whereas advanced courses should emphasize teaching implementation, like how to use digital tools for student learning analysis and explanation..

5.3 Digital Environment Construction

A good digital environment can effectively support the digital teaching, learning and research activities. The construction encompasses optimizing, managing, and maintaining digital facilities, educational software, resources, and network security, etc. Therefore, a comprehensive enhancement strategy should be established to ensure the optimization of facilities and digital resources. Meanwhile, it is imperative to foster a conductive digital teaching atmosphere through diverse activities. Activities like digital showcase courses and open classrooms can establish benchmarks and foster inter-teacher communication. Besides, encouraging the effective utilization of digital tools among teachers, students, and enterprises, promotes the digital transformation within higher education.

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References

Carmines, E. G., & Zeller, R. A. (1979). *Reliability and validity assessment*. SAGE Publications.

European Commission. (2013). *DigComp 2.1: The Digital Competence Framework for Citizens*. Retrieved from https://joint-research-centre.ec.europa.eu/digcompedu_en

Feng, L., & Sumettikoon, P. (2024). An empirical analysis of EFL teachers' digital literacy in Chinese higher education institutions. *International Journal of Educational Technology in Higher Education, 21*, 42. https://doi.org/10.1186/s41239-024-00474-1

Gilster, P., & Glister, P. (1997). *Digital literacy* (p. 1). Wiley Computer Pub.

Hairida, H., Benő, C., Soeharto, S. et al. (2023). Evaluating Digital Literacy of Pre-service Chemistry Teachers: Multidimensional Rasch Analysis. *Journal of Science Education and Technology*, *32*(4), 643-654. https://doi.org/10.1007/s10956-023-10070-z

Huang, F. (2024). Examining Foreign Language Teachers' Information Literacy: Do Digital Nativity, Technology Training, and Fatigue Matter? *Asia-Pacific Education Research*, *33*(8), 901-912. https://doi.org/10.1007/s40299-023-00797-z

Ministry of Education of the People's Republic of China. (2022). *Digital Literacy of teachers 2022*. Retrieved from http://www.moe.gov.cn/srcsite/A16/s3342/202302/t20230214_1044634.html

Porat, E., Blau, I., & Barak, A. (2018). Measuring digital literacies: Junior high-school students' perceived competencies versus actual performance. *Computers and Education*, *126*, 23-36. https://doi.org/10.1016/j.compedu.2018.06.030

UNESCO. (2018). *Information and Communication Technology (ICT) Competency Framework for teachers 2018*. Retrieved from https://www.unesco.org/en/articles/unesco-ict-competency-framework-teachers