Research on the Current Situation and Enhancement Strategies of Digital Literacy of Preschool Education Pre-service Teachers in the Era of Artificial Intelligence

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Abstract. In the era of artificial intelligence, the digital literacy of Preschool Education pre-service teachers is particularly important. This study used the questionnaire survey method and recovered 387 questionnaires. Through statistical analysis, it was found that the overall digital literacy of Preschool Education pre-service teachers was at a medium level, and among the four dimensions, digital ethics scored the highest and digital knowledge and skills scored the lowest. Combined with the analysis of influencing factors, this study proposes that colleges and universities should strengthen digital literacy publicity and education, increase funding to improve the digital foundation, improve the digital curriculum system, enrich the forms of digital literacy training, and do a good job of monitoring and evaluating students' digital literacy, and pre-service teachers majoring in Preschool Education should pay attention to the study of digital literacy to improve the level of digital knowledge, skills and digital professional development.

Keywords: artificial intelligence era, Preschool Education pre-service teachers, digital literacy, enhancement strategies.

1 Introduction

In the era of artificial intelligence, technologies represented by machine learning, cloud computing, natural language processing and so on have brought about changes in social productivity and transformation of social patterns, profoundly impacting the economy, culture, education and other fields, and bringing about a great impact on traditional school education and the teaching profession in various countries. Digital literacy has become an important target point for educational innovation in countries in the digital era, and is a key literacy and core skill in the age of artificial intelligence. China's Ministry of Education released the industry standard of Digital Literacy for Teachers in 2022, and the Ministry of Education and other departments jointly issued the Key Points for the Enhancement of Digital Literacy and Digital Skills of All People in 2024 in 2024, and all of the above policy documents have proposed the

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cultivation of high-level composite digital talents, which all provide support for the comprehensive enhancement of digital literacy for pre-service teachers[1].The reason why this study focuses on the digital literacy of Preschool Education pre-service teachers is that in the field of Preschool Education policy, both the Professional Standards for Early Childhood Teachers and the Professional Competencies for Preschool Education pre-service teachers have set requirements for early childhood teachers in terms of digital awareness, digital knowledge and skills, digital application ability, and digital social responsibility from different dimensions; and secondly, in the field of Preschool Education theory, James Joseph Heckman's research shows that the return on investment of Preschool Education is higher than that of other school segments. Third, in the field of Preschool Education practice, kindergarten directors in Beijing, Nanjing and Shanghai have shown a high level of digital management and teaching in the construction of resource platforms. Therefore, for colleges and universities, the research on digital literacy of pre-service teachers specializing in pre-school education is imminent, both from the perspective of talent cultivation and social service.

2 Literature Review

There are fewer empirical studies on the digital literacy of preservice teachers in Preschool Education major, which explains the urgency and necessity of this study. There are many studies on digital literacy of pre-service teachers at home and abroad, while fewer studies focus on digital literacy of pre-service teachers majoring in preschool education. The research on digital literacy of pre-service teachers mainly focuses on the concept of digital literacy [2] evolution [3], the current situation, characteristics, influencing factors [4], the construction of the indicator system and framework, the cultivation of digital literacy, and the evaluation of digital competence. Research on digital literacy in the field of Preschool Education mainly focuses on the digital literacy of early childhood teachers [5], and lacks attention to the digital literacy of pre-service teachers specializing in preschool education, and the relevant research mainly explores the construction of the indicator system of digital literacy in Preschool Education major from the theoretical level [6]. There are fewer empirical studies on the digital literacy of preservice teachers in Preschool Education major, which explains the urgency and necessity of this study.

3 Research Design

3.1 Research Tools

In this study, the Digital Literacy Status Questionnaire for Preschool Teacher Education Students prepared by Dan Xiao [7] and Yueyan Wang [8] was used, which mainly consists of four dimensions: digital awareness, digital knowledge and skills, digital development, and digital morality, and a five-point Likert scale was used, with a score of 1 representing complete noncompliance and 5 representing complete compliance,

and the Cronbach's alpha for each question in this study's questionnaire was 0 . 954, indicating that the questionnaire has good reliability.

3.2 Survey Respondents

In this study, pre-service teachers from freshman to senior year of Preschool Education major in two universities in Shaanxi Province were randomly selected as research subjects. The questionnaires were prepared and placed through the Questionnaire Star APP, and a total of 387 questionnaires were collected. From the basic situation of the pre-service teachers of Preschool Education major who participated in the survey, most of them were female (94.32%), Han Chinese (95.61%), and from rural areas (53.49%). Students who first contacted the Internet were mainly concentrated after the first grade of elementary school (97.42%). 83.72% of the students owned personal computers, and the time spent on digital media was concentrated at 2-10 hours per day (78.81%), but the proportion of those who had obtained the second level certificate of computer was only 3.1%.

4 Analysis of findings

4.1 The Current Situation of Digital Literacy among Preschool Education Pre-service Teachers

The mean score of digital literacy of preservice teachers in Preschool Education was 3.655, which is generally in the middle level. Through comparison, it was found that the digital ethics dimension had the highest mean score of 3.973, indicating that pre-service teachers attached great importance to digital ethics. The mean scores of the other four dimensions were lower than the overall mean score, but the difference between the mean scores of the dimensions was small, from high to low: digital professional development literacy 3.598, digital awareness 3.584, and digital knowledge and skills 3.534. This suggests that Preschool Education pre-service teachers need to strengthen their learning in these three dimensions, especially digital knowledge and skills.

4.2 Analysis of Gender Differences in Digital Literacy of Preschool Education Pre-service Teachers

Analysis of the data showed that the effect of gender on digital literacy of Preschool Education pre-service teachers was not significant ($P=0.17>0.1$), but there was a significant difference between Preschool Education pre-service teachers of different genders in the dimension of digital awareness ($P=0.043<0.05$) as shown in Table 1.Through cross-tabulation analysis, it was found that girls had higher mean scores than boys on the dimension questions Q14 Awareness of using digital for continuous professional development, Q13 Understanding the value of digital for teachers' educational and teaching work, and Q16 Courage to face the difficulties in digital teaching

and learning. Thus females were significantly higher than males in the dimension of digital awareness.

Table 1. Independent samples t-test for digital literacy of pre-service teachers in Preschool Education of different genders

Variable Name	Gender	M	SD	t	P
Digital awareness	Male	3.336	0.702	2.305	0.043**
	Female	3.600	0.582		

Note: ***, **, * represent 1%, 5% and 10% significance levels, respectively. (Same as below)

4.3 Analysis of Time Differences in Digital Literacy Net Age of Preschool Education Pre-service Teachers

As shown in Table 2, there were significant differences in digital literacy among preschool Preschool Education pre-service teachers with different net ages (P=0.005< 0.01). In terms of specific dimensions, there were significant differences in digital knowledge, skills, and digital professional development dimensions among different net ages. Post hoc tests between groups using the LSD method found that in the digital knowledge and skills dimension, students who were exposed to the Internet before freshman year were significantly more digitally literate than those who were exposed to the Internet after freshman year; and in the digital professional development dimension, students who were exposed to the Internet after the first grade of elementary school were significantly more digitally literate than those who were exposed to the Internet after the first grade of elementary school. Overall, the earlier the exposure to the Internet, the better the development of pre-service teachers on the dimensions of digital knowledge and skills and digital professional development. Interviews revealed that this difference is related to the level of Internet penetration in the region where each student's family is located and the ease with which information is available to the family. Students from the central and eastern regions and urban families had access to the Internet earlier and for a longer period of time than students from the western regions and rural families.

Table 2. One-way ANOVA for digital literacy among pre-service teachers of Preschool Education major of different net ages

Variable Name	Time	M	SD	F	P	LSD
Digital Knowledge and Skills	University	3.1628	0.634	5.852	0.000***	B>A
	High school	3.4803	0.502			C>A
	Middle school	3.5254	0.576			D>A
	Elementary school	3.6325	0.688			E>A
	Kindergarten	3.9091	0.537			E>B
Digital Professional Development	University	3.3333	0.793	3.752	0.005**	D>A
	High school	3.5000	0.487		*	D>B

	Middle school	3.5480	0.653			D>C
	Elementary school	3.7168	0.738			E>A
	Kindergarten	3.9167	0.713			
Population	University	3.4025	0.616	3.814	0.005**	C>A
	High School	3.6089	0.411		*	D>A
	Middle school	3.6330	0.496			E>A
	Elementary school	3.7383	0.599			
	Kindergarten	3.8852	0.561			

Note: A denotes university, B denotes senior high school, C denotes middle school, D denotes elementary school, and E denotes kindergarten.

4.4 Differential Analysis of Daily Hours of Digital Literacy Media Use among Preschool Education Pre-service Teachers

As shown in Table 3, different durations of daily use of digital media had a significant effect on Preschool Education pre-service teachers' digital literacy (P=0.034<0.05). In terms of specific dimensions, different hours of use showed significant effects on the dimensions of digital awareness (P=0.005<0.01) and digital morality (P=0.038<0.05), and the LSD test showed that students using digital media for more than 6 hours a day were significantly more likely to be more digitally aware than those who used it for less than 2 hours a day, while students using digital media for more than 2 hours a day were significantly more likely to be more digitally ethical than those using digital media for less than 2 hours a day. morality dimension was significantly higher than those who used less than 2 hours per day. It was found in the interviews that students who spent more than 6 hours online per day browsed more information on various webpages and had a stronger experience of digital change in learning and life, and thus the dimension of digital awareness was higher than that of students who spent less than 2 hours online. Digital ethics is the same.

Table 3. One-way ANOVA for digital literacy among Preschool Education pre-service teachers with different hours of digital media use

Variable Name	Time(h)	M	SD	F	P	LSD
Digital awareness	0-2	3.377	0.554	4.367	0.005***	C>A
	2-6	3.541	0.566			D>A
	6-10	3.650	0.591			D>B
	≥10	3.795	0.665			
Digital ethics	0-2	3.700	0.830	2.836	0.038**	B>A
	2-6	3.970	0.690			C>A
	6-10	4.048	0.668			D>A
	≥10	4.047	0.756			
Population	0-2	3.466	0.632	2.926	0.034**	C>A
	2-6	3.629	0.509			D>A
	6-10	3.728	0.549			
	≥10	3.737	0.642			

Note: A represents 0-2h, B represents 2-6h, C represents 6-10h, and D represents ≥10h.

4.5 Summary of The Problems of Digital Literacy among Preschool Education Pre-service Teachers

4.5.1 Digital Awareness: Passive Adaptation and Lack of Courage

In terms of the mean scores of the questions in the digital awareness dimension, in descending order, they were as follows:Q14 using digitalization to promote teachers' continuous professional development (3.79), Q13 understanding the value of information to promote teachers' educational and teaching work (3.73), Q12 understanding the willingness to learn a new digital medium (3.72), Q16 being courageous enough to face the difficulties of digital teaching and learning (3.67), and Q15 taking the initiative to use digital information technology to optimize education and teaching (3.02). This indicates that Preschool Education pre-service teachers are more aware of their digital professional development and have a high degree of acceptance of the digitalization of education and teaching, but are relatively conservative and passive. Combined with the investigation of the influencing factors of Q44, it was found that Preschool Education pre-service teachers lacked interest in understanding new media due to the limitations of their personal disciplinary perspectives, were intimidated by difficulties in digital teaching, and lacked the courage to deal with the difficulties of digital teaching.

4.5.2 Digital Knowledge and Skills: Disconnect between Theory and Practice

In terms of the mean scores of the questions in the digital knowledge and skills dimension, in descending order, Q18 has knowledge of basic office software applications (3.83), Q17 can use digital tools to download resources (3.80), Q20 selectively identifies digital information (3.70), Q27 solves real-world problems (3. 58), and Q24 applies digital tools to complete teaching and learning tasks (3.51),. Q25- Q26 comprehending integrating information (3.46), Q21-Q23 searching for curriculum-related resource problems (3.416), and Q19 acquiring knowledge of photo, audio, and video information processing software applications (3.28). This shows that pre-service preschool teachers are weak in solving practical problems, applying digital tools for teaching tasks, understanding and integrating information, searching for professionally relevant resources, and mastering complex forms of information processing software. Combined with Q44, it can be seen that the improvement of preservice teachers' digital knowledge and skills in Preschool Education is mainly limited by the disconnection between digital theory learning and practice. In addition, in Q10 Digital Information Retrieval, only 35.92% of the students chose subject-specialized websites, indicating that pre-service teachers received insufficient educational guidance in professional digital retrieval.

4.5.3 Digital Professional Development: Lack of Motivation for Continuous Learning

In terms of the mean scores for each question of the digital professional development dimension, in descending order, Q29 and Q30 use digital tools to facilitate collaborative learning (3.635), Q33 use digital tools to expand information sources

(3.60), Q31 and Q32 use digital tools to produce digital outputs (3.59), and Q28 adjust teaching strategies with the help of digital tools (3.55). This shows that pre-service teachers in Preschool Education are less capable of producing digital outputs and using digital tools to enhance their teaching. Meanwhile, many pre-service teachers lacked the motivation for continuous learning in the process of digital professional development, and only emphasized the integrity of instructional design and implementation, and slighted the learning of digital knowledge and skills.

5 Conclusions

Based on the current situation of Preschool Education pre-service teachers' digital literacy, the factors affecting it, and Q45 Preschool Education pre-service teachers' suggestions for improving their own digital literacy, this study can give the following strategies from the dimensions of educational management in higher education and the consistency of personal knowledge and behavior.

5.1 Universities: Digital Education and Management Is the External Environmental Guarantee

Firstly, administrators should increase publicity efforts to publicize the importance of digital literacy to the Preschool Education pre-service teachers to create a good educational atmosphere for the improvement of digital literacy.

Secondly, they should increase the economic investment in digital literacy education, improve the school digital education resource platform and basic informatization facilities, and establish a sound basic guarantee system for digital literacy education.

Thirdly, teachers should strengthen the professional training of Preschool Education pre-service teachers and offer digital literacy enhancement courses. At the same time, teachers should also update the content of digital education courses with the times, so that the content of the courses meets the needs of kindergarten employers as well as the learning needs of students. For example, artificial intelligence can be introduced into classroom teaching, so that students can understand what artificial intelligence is and how it can be applied to preschool education.

Fourthly, the innovative cultivation method of digital literacy education should take into account both collective and individual, online and offline, as well as diversity and fun. In the era of new media, colleges and universities can explore and innovate cultivation methods by utilizing short video platforms, WeChat public numbers, salons, lectures and other forms. Second-level colleges can open learning websites, student clubs, and competitions that specifically serve the digital literacy training of preschool teacher education students, providing students with more opportunities to combine theory and practice.

Finally, teachers of professional courses should integrate digital literacy into classroom teaching, and also pay attention to be good role models for students, seriously guide and supervise students' professional digital learning, and pay attention to the assessment and evaluation of students' digital literacy dimensions.

5.2 Individual: the Unity of Knowledge and Action Is the Guarantee of Internal Motivation

First of all, pre-service teachers majoring in Preschool Education should pay attention to improving their own digital literacy, actively adapt to the real needs of kindergartens for pre-service teachers' digital literacy in the process of digitalization of education, overcome the fear of difficulties, and face up to the challenges they may encounter in the study of digital teaching.

Secondly, pre-service teachers majoring in Preschool Education should improve their own digital knowledge and skills. From the freshman year, it is necessary to improve the subjective initiative, study and practice more. Actively participate in various courses of study, competitions, clubs and other activities, such as Pre-service Teachers' Microteaching Competition, Pre-service Teachers' Skills Competition, Network Innovation Competition and so on.

Thirdly, Preschool Education pre-service teachers should improve digital professional development literacy. Improve the ability to acquire effective and valuable information in an all-round way, and develop the ability to create and innovate digital content.

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