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Research on the Current Situation of Artificial Intelligence Literacy of Teacher Trainees and Strategies to Improve It

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Abstract: The era of artificial intelligence has put forward new requirements for the necessary literacy of teachers, and teacher trainees are the backbone of future teaching positions, so strengthening the cultivation of their AI literacy is an intrinsic need to realize the development of high quality in education. This study mainly adopts the questionnaire survey method and interview method to investigate 430 teacher trainees from H Teachers College, to understand the current status of the development of teacher trainees' artificial intelligence literacy, to clarify the existing problems and to propose corresponding enhancement strategies. The results of the study show that the level of teacher students' artificial intelligence literacy needs to be improved, specifically, the teacher students' artificial intelligence knowledge reserve is insufficient, the artificial intelligence ability is weak, and there is room for strengthening the artificial intelligence awareness. Based on this, the article puts forward the enhancement strategy of teacher trainees' artificial intelligence literacy, aiming to provide a certain reference basis for strengthening the cultivation of teacher trainees' artificial intelligence literacy.

1. Introduction

Artificial intelligence technology is developing rapidly, and we are moving from the information age to the age of artificial intelligence, and education needs to adapt to the development of the times and cultivate strategic talents for the country [1]. Artificial intelligence technology empowers education teaching and promotes the updating and transformation of the education model, education ideas, education methods, etc. The "artificial intelligence + education" model has become an important development trend of education in the future. Teachers play a key role in the integration of AI and education, and their AI literacy is an important factor affecting educational change. As the reserve army of future school teachers, college teacher trainees are responsible for cultivating students with Artificial Intelligence (AI) literacy, so it is especially important for them to have a certain degree of AI literacy. At the same time, it is a requirement for teacher trainees to be trained in AI by integrating technology for subject teaching in an AI environment and enhancing AI teaching competence [2]. Based on this, this study aims to investigate the current situation of the development of teacher trainees' AI literacy, sort out the problems that exist in it, and put forward

an effective strategy for the cultivation of teacher trainees' AI literacy, which is conducive to reaching the cultivation goal of teacher trainees' AI literacy.

This study was guided by two research questions:

RQ1. What is the level of AI literacy among teacher educators? What are the problems?

RQ2. How to effectively improve the AI literacy of teacher trainees?

2. Literature review

2.1 Artificial intelligence literacy

In the current era of artificial intelligence, scholars have long been concerned about and carried out research on artificial intelligence literacy, and since 2018, the research on artificial intelligence literacy in the field of education has opened a boom [3]. Artificial intelligence literacy is a concept put forward by scholars in accordance with the current requirements of the intelligent society, and its corresponding connotation is constantly updated and enriched with the advancement of related research. According to Prof. Cynthia Breazeal of the Massachusetts Institute of Technology (MIT) in the United States abroad, AI literacy is the embodiment of the core concepts of AI in computational thinking and design thinking, including perception, representation and reasoning of AI technology, machine learning, human interaction and social impact [4]. Through literature reading, this paper combed the definitions of AI literacy in the last five years at home and abroad, as shown in Table 1.

Table 1: Definition of Artificial Intelligence Literacy

Proposer	Definition of Artificial Intelligence Literacy
Zhao Feilong(2018)[5]	It is an important part of scientific literacy, aiming to cultivate students' AI appreciation, AI understanding, and AI application.
Wang Ming (2018)[6]	A multidimensional composite structure integrating intelligent knowledge, intelligent ability, intelligent sentiment and intelligent ethics.
Zhou Shaojin (2019)[7]	It refers to the basic comprehensive literacy in the era of artificial intelligence, which mainly includes three cultivation stages: intelligent attitude, mastery of intelligent tools, and the use of AI disciplinary thinking to solve real-world problems.
Hou Hezhong (2020)[8]	It refers to having the ability to understand intelligence, apply intelligence, and develop intelligence, which mainly includes intelligent awareness, intelligent attitude, intelligent ethics, intelligent knowledge, intelligent skills, intelligent thinking, and intelligent innovation.
Long(2020)[9]	It includes the ability to use AI as a learning tool, to communicate and collaborate with AI, and to evaluate AI technologies.
Wong (2020)[10]	It includes "AI concepts, AI applications, and AI ethics".
Zheng Qinhua (2021)[11]	It should include five dimensions: intelligent knowledge, intelligent ability, intelligent thinking, intelligent application, and intelligent attitude.
YANG HONGWU (2022)[12]	A kind of comprehensive literacy that individuals should have for survival and development in the age of intelligence, including core concepts and technical practices related to artificial intelligence, as well as interdisciplinary thinking and ethical attitudes formed in the process of technical practices.
WILTON L(2022)[13]	Competencies required to critically evaluate AI technologies.
Kong(2023)[14]	It includes conceptual understanding, literacy, empowerment, and ethical awareness.

According to different scholars' definitions of AI literacy, it can be found that AI literacy is not a single knowledge or understanding of AI technology, but consists of a variety of literacies, which are comprehensive literacies developed by individuals in order to adapt to the AI era and society.

Artificial intelligence literacy contains multiple dimensions, which are proposed differently by different scholars, but roughly include AI knowledge, AI competence, AI attitude and ethics, which provide the theoretical basis and reference basis for defining AI literacy in this study.

2.2 Artificial intelligence literacy for teacher educators

As an important participant in basic education, teacher trainees play a key role in the modernization and reform of education and teaching, and their level of artificial intelligence literacy has a direct impact on the level of students' intelligent literacy development. The artificial intelligence literacy that teacher trainees should have includes both the intelligence literacy that is necessary for people in modern society in a broad sense and the teacher's intelligence literacy that should be possessed by cultivating talents with intelligence literacy. The cultivation of artificial intelligence literacy should not only learn the relevant knowledge of artificial intelligence disciplines, but also have a certain degree of data literacy and information literacy, and master the relevant artificial intelligence technology [15]. In this study, we chose to read the literature with teacher intelligence literacy as a keyword, from which we summarized the definition of teacher trainees' artificial intelligence literacy, as shown in Table 2.

Table 2: Definition of Artificial Intelligence Literacy of Teacher Trainees

Proposer	Definition of Artificial Intelligence Literacy
Yu, Xiaoya (2019)[16]	It should include understanding ICT in education, curriculum and assessment, teaching and learning, organization and management, ICT, teacher professional learning, safety and law, ethics and morality.
Xu Yafeng (2020)[17]	It is both a methodology for teachers to implement teaching and learning in the age of digital intelligence and includes a set of competency structures consisting of knowledge, skills and attitudes.
Guo Jiong (2021)[18]	Possesses an intelligent educational literacy that covers the three dimensions of technology, education, and society.
Hu Xiaoyong (2021)[19]	It should include knowledge dimension, ability dimension, thinking dimension and cultural dimension.
Xiang Li (2021)[20]	A comprehensive literacy for teachers to be competent in teaching and learning in the intelligent era, which is the concretization of AI literacy for citizens of the intelligent society in the professional work of education.
Wang Dan (2022)[21]	A comprehensive literacy for teachers to use artificial intelligence technology to improve teaching and management effectiveness, innovate talent training mode, shape intelligent ethics and value norms, and improve students' personalized and intelligent learning level and innovation ability.
Pengjiao Wang (2023)[22]	It constructed an AI literacy framework for teacher trainees based on AI-TPACK with AI knowledge, AI competence, and AI ethics as the first-level framework.
Ding S. Q. (2023)[23]	The sum of various psychological qualities such as relevant attitudes, values, knowledge, techniques, methods and skills that teachers should have to carry out AI education in the basic education stage.
Velander (2023)[24]	Teachers' technical, pedagogical and content knowledge related to artificial intelligence is an important factor in artificial intelligence literacy.
Casal-Otero (2023)[25]	It encompasses AI knowledge, competencies and attitudes.

Different scholars have not reached a unity on the concept of teachers' intelligent literacy, but

most of them define teachers' artificial intelligence literacy as a comprehensive literacy that covers knowledge, technology, awareness and other aspects. Through the organization of scholars at home and abroad on the intelligent literacy that teachers should have, we can understand the basic dimensions included in artificial intelligence literacy. This study defines the artificial intelligence literacy of teacher trainees as the literacy gradually formed by teacher trainees' comprehensive and integrated development in terms of knowledge, ability and consciousness. And it serves them to adapt to the social development and personal autonomy development in the age of intelligence and to be better qualified for the future teaching profession.

3. Method

3.1 Participants

Teacher training students from different majors of Huanggang Teachers College in Huanggang City, Hubei Province participated in this questionnaire survey. The study used simple random sampling method, which lasted one month, and 455 questionnaires were recovered. Among them, the effective sample size was 430, and the effective questionnaire recovery rate was 94.5%.

3.2 Instruments

A data collection and evaluation tool was used to measure teacher trainees' current level of AI literacy in each of the three dimensions of AI knowledge, AI competence, and AI awareness. In order to further improve the match of the questionnaire[26], the Artificial Intelligence Literacy Assessment Tool for Teacher Trainees was further analyzed and content constructed. After asking for suggestions from experts in the field, some of the questions were revised to form the Self-Assessment Scale of AI Literacy for Teacher Trainees, with a total of 29 scale questions designed for each of the three dimensions, which were scored using the five-point Likert scale method, and were recorded as a score of 1-5, respectively.

3.3 Reliability and validity tests

The reliability and validity of the questionnaire were analyzed after the data were recovered, and the results showed that the alpha value of the overall scale was 0.964, and the alpha values of the three dimensions of AI knowledge, AI ability, and AI awareness were 0.928, 0.928, and 0.933, respectively, as shown in Table 3. The Cronbach's α values of the overall scale and the three dimensions are all greater than 0.7, indicating that the internal consistency of the scale is good and has high reliability. By performing exploratory factor analysis in SPSS software, the KMO value was 0.951, which was greater than 0.7, indicating that it was suitable for factor analysis. The chi-square value of Bartlett's test of sphericity was 10905.824 and the Sig value was 0.000, which is less than 0.05, indicating that the validity of the questionnaire in this study is good. In conclusion, the scale used in this study has good reliability and validity to reflect the level of artificial intelligence literacy of teacher trainees.

Table 3: Reliability of the questionnaire

Name	Cronbach's alpha	Number of items
Overall scale	0.964	29
Artificial intelligence knowledge	0.928	7
Artificial intelligence ability	0.928	10
Artificial Intelligence Awareness	0.933	12

4. Results

4.1 Statistics on demographic variables

The study has tabulated the demographic variables of the selected respondents as shown in Table 4. The overall predominance of the female group of teacher trainees is in line with the reality of the teacher trainee group and most of the respondents were from the rural areas, with the majority of the number in the lower grades.

Table 4: Statistical analysis of demographic variables

Demographic Variables	Options Categorization	Sample size	Percentage
Gender	Male	74	17.21%
	Female	356	82.79%
Place of residence	Rural	196	45.58%
	Town	130	30.23%
	Urban	102	23.72%
	Other	2	0.47%
Year	Freshman	178	41.4%
	Sophomore	92	21.4%
	Junior	73	16.98%
	Senior	24	5.58%
	First year graduate students	13	3.02%
	Second year graduate students	36	8.37%
	Third year graduate students	14	3.26%

At the same time, the study analyzed the descriptive statistics of the basic information of the teacher trainees who participated in the survey to fill in the situation of offering AI courses and participating in AI clubs or training. The results show that most of the teacher trainees' majors are not majors that offer AI courses, accounting for 86.98% of the total, and very few teacher trainees answered that they participate in associations or training, accounting for only 9.3% of the total. It can indicate that the school artificial intelligence courses are not enough, and the training of teacher trainees needs to be popularized.

4.2 The State of Artificial Intelligence Literacy

To further understand the degree of artificial intelligence literacy development of teacher trainees. This study analyzed the descriptive statistics of the current status of AI literacy of teacher educators in general, and the statistical results are shown in Table 5.

Table 5: Status of Overall Artificial Intelligence Literacy among Teacher Trainees

Name	sample size	average value	standard deviation
Overall scale	430	3.68	0.75
Artificial intelligence knowledge	430	3.57	0.80
Artificial intelligence ability	430	3.52	0.63
Artificial Intelligence Awareness	430	3.87	0.62

On the whole, the mean value of the overall AI literacy score of teacher trainees is 3.68, between 3 and 4, indicating that the overall AI literacy of teacher trainees is at an average level and the development is not balanced. Analyzed separately from the three dimensions, in the AI knowledge dimension, the mean value is 3.57, close to 3, and the standard deviation is 0. 80. This result indicates that the teacher trainees' AI knowledge level is average and the knowledge reserve is insufficient. In the dimension of AI ability, the mean value is 3.52, the lowest among the three dimensions, and the standard deviation is 0. 63, which indicates that the teacher trainees' AI ability

is relatively at a low level and relatively weak. In the AI awareness dimension, the mean value is 3.87, close to 4, which is the highest among the three dimensions. And its standard deviation is 0.62, indicating that the AI awareness of teacher trainees is at a high level, i.e., they have a positive attitude and are more rational. It also indicates that they have a positive attitude and a more rational understanding of AI technology and educational applications. The survey shows that most teacher trainees can realize the over-reliance on technology and privacy issues that may be brought about by AI technology, but the mean value of the corresponding part of the question item does not reach a high level. In the interviews, some teacher trainees did not recognize the negative role of AI in ethics and morality, indicating that there is still room for teacher trainees to strengthen their awareness of this AI. Comparison of the overall data shows that the surveyed teacher trainees performed best in the dimension of AI awareness and the data are relatively concentrated, and they performed generally in AI knowledge and AI competence, with a small level gap.

5. Discussion

5.1 School level: raising the importance of AI education and improving training objectives

As the main ground for training future teachers, teacher training colleges have an important role to play in improving the artificial intelligence literacy of teacher trainees. In order to meet the needs of future education, institutions should pay more attention to the cultivation of teacher students' AI literacy and incorporate it into their talent training objectives. On the one hand, increase the financial investment in the school's smart equipment and AI laboratories to provide teacher trainees with diversified learning materials and practical operation environments. At the same time, based on the actual situation of the existing smart environment and resources in the institutions and the curriculum standards and practice requirements of primary and secondary schools, artificial intelligence courses related to students' life, learning and education and teaching are offered. Among the suggestions for AI education in schools, teacher-training student S1 said that "in addition to adding hardware facilities, schools should also add AI-related elective courses so that students can have a wide range of knowledge to better adapt to modern life." On the other hand, according to the development trend of AI technology, institutions should timely adjust and improve AI training objectives, and permeate AI education in the teaching of different specialized disciplines. This includes the cultivation of students' AI theoretical knowledge, application ability and ethics, and actively constructing an AI literacy evaluation system to evaluate the literacy of teacher trainees from multiple dimensions.

5.2 Teacher level: updating teaching concepts and strengthening intelligent teaching skills

Emerging artificial intelligence technology promotes changes in the field of education, requiring teachers to firstly update their traditional teaching concepts, change the indoctrination mode of teaching, integrate the knowledge of the subjects they teach with artificial intelligence, and give full play to the advantages of artificial intelligence in intelligent teaching. In teaching, teachers should adapt to the school's intelligent teaching environment and teaching methods, take the initiative to master AI-related technologies, and gradually realize human-machine collaborative parenting; secondly, teachers should constantly require self-professional development in accordance with the educational changes, participate in AI academic conferences, seminars and forums, and schools with the conditions can open AI teacher training course construction with online and offline multiple teaching and research activities to improve teachers' professional literacy [27]. At the same time, teachers should effectively understand the current situation and characteristics of students' learning in actual teaching, and promote students' personalized learning in intelligent teaching.

5.3 Student level: building a sense of active learning and continually strengthening AI teaching competencies

Enhancing the quality of teacher training students can provide an abundant qualified reserve army for the construction of high-quality teams [28]. As the future frontline teachers of basic education, teacher trainees should have the concept of lifelong learning, be willing to accept the new technology of artificial intelligence, and actively use it in their daily life and learning to improve the efficiency of their learning and teaching. First, teacher trainees should fully understand the knowledge related to AI, be good at using the resources provided by AI tools, and learn and update new methods of integration with education and teaching. Teacher trainees should change from passively accepting knowledge to actively learning and improving, and constantly increase their knowledge reserves by actively focusing on the innovative application of cutting-edge AI technology in education, attending more lectures by experts in the field of AI education, and learning about the latest developments in new technologies; second, the practical character of the field of AI is obvious, and teacher trainees should actively participate in the application of AI and teaching practice, actively explore and apply the artificial intelligence technology. At the same time, the study found that teacher trainees do not have a strong awareness of the ethical safety issues involved in AI. Scholars have already shown the need to pay attention to the social problems caused by AI and reflect on the ethical risks latent in it [29]. With regard to the privacy, ethical and moral issues that may arise from AI, teacher trainees should be able to review and circumvent them in the process of using AI, and use AI tools legally and reasonably. Future education should emphasize the education of morality, wisdom and sentiment, which is also the obligation that teachers must adhere to in the age of AI [30]. In short, future teacher trainees should be able to be competent in intelligent education and achieve the goal of cultivating intelligent talents, and they should strengthen their own quality from all aspects of AI knowledge, ability, and awareness, so as to lay a solid foundation for taking up the workplace.

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