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Research on Self-Improvement Pathways for Intelligent Education Literacy of Teacher Trainees in Northwestern Guangdong

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Abstract: With the deepening integration of "Artificial Intelligence + Education" the intelligent education literacy of teacher trainees has become a key factor influencing the quality of future education. This study targets teacher trainees within the under-resourced context of northwestern Guangdong. Guided by AI-TPACK and self-determination theories and grounded in a comprehensive literature review, this study systematically analyzes key issues within the three dimensions of intelligent literacy: learning, teaching, and ethics. The research reveals that teacher trainees in northwestern Guangdong commonly encounter multiple challenges, such as inadequate curriculum relevance, uneven distribution of learning time, limited access to practical teaching opportunities, underdeveloped technological integration skills, and a superficial grasp of ethical issues. Accordingly, from the perspective of teacher trainees' self-development, this study constructs a literacy enhancement pathway centered on the "cognition-practice-reflection" framework. This pathway is advanced through strategies like resource integration, scenario-based training, and ethical internalization, aiming to foster the autonomous growth of their intelligent education literacy.

Keywords: Teacher Trainees in Northwestern Guangdong; Intelligent Education Literacy; Self-Improvement Pathways

1. Introduction

The rapid advancement of artificial intelligence has introduced significant challenges and transformative pressures to the education sector. As pre-service teachers, teacher trainees' proficiency in intelligent education will inevitably influence the quality of future educational development. The 2024 World Digital Education Conference further emphasized the need to "restructure digital education and teaching processes, creating a new paradigm for intelligent education" [1], posing explicit and pressing demands on the intelligent literacy of future educators. However, deficiencies are present within the cohort of teacher trainees concerning their literacy in intelligent education, particularly in the application and transformation of intelligent technological knowledge. This not only affects their future career development but also hinders their ability to meet the competency requirements for new-era teachers in the intelligent age. In light of this context, the investigation into effective strategies for improving teacher trainees' proficiency in intelligent education literacy has become critically urgent. This study addresses these shortcomings by providing a novel methodological approach centered on self-improvement pathways from the teacher trainees' own perspective.

Unlike the traditional strategies for cultivating the qualities of normal school students, this study breaks through the limitations of the traditional macro cultivation model and shifts the research perspective to the micro level where normal school students are the main body of development. This shift not only enhances the practical applicability of the proposed strategies but also introduces a new research perspective for studies on intelligent education literacy strategies for teacher trainees. Building on prior empirical research and literature analysis, this paper delves into the specific challenges encountered by teacher trainees in northwestern Guangdong within the three core dimensions of intelligent literacy: learning, teaching, and ethics. Based on these existing issues, it

proposes enhancement strategies from the trainees' own standpoint, aiming to provide effective reference for the professional development of regional teacher trainees.

2. Theoretical Foundations and Framework Analysis

2.1 Theoretical Model of Teacher Trainees' Intelligent Education Literacy from the AI-TPACK Perspective

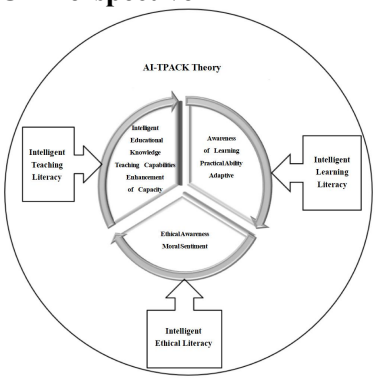

Figure 1. Intelligent Educational Literacy Model for Teacher Trainees

The Intelligent Educational Literacy Model for Teacher Trainees proposed by Mo and Yu in 2024 is grounded in AI-TPACK theory. It constructs a systematic theoretical framework centered on three core dimensions: Intelligent Learning Literacy, Intelligent Teaching Literacy, and Intelligent Ethical Literacy [2] (as shown in Figure 1), providing crucial theoretical support for cultivating teacher trainees' intelligent education literacy. The Intelligent Learning Literacy dimension centers on teacher trainees' primary role as “learners” comprising three sub-dimensions: awareness of learning, practical ability, and adaptability. The Intelligent Teaching Literacy dimension integrates AI-TPACK theory, emphasizing that teacher trainees should "facilitate learning through teaching". It consists of three sub-dimensions—AI-integrated intelligent education knowledge, AI-integrated teaching competence, and enhancement capacity—forming a closed-loop "knowledge-competence-enhancement" system. Beyond this, Intelligent Ethical Literacy serves as an indispensable component for enhancing teacher trainees' intelligent education literacy. It encompasses two sub-dimensions: ethical awareness and moral sentiment. This dimension emphasizes privacy protection and fosters the ethical awareness of using AI properly, while upholding the fundamental principles of educational ethics and legal compliance. In summary, this model not only addresses the competency demands of "Intelligence+ Education" for teacher trainees, but also takes into account their dual identity characteristics, thereby providing a clear theoretical reference for them to systematically understand the connotation of intelligent education literacy and explore its cultivation paths.

2.2 Theoretical Necessity of the Self-Improvement Pathway: An Explanation Based on Self-Determination Theory

Self-Determination Theory (SDT), proposed by Deci and Ryan in the 1980s, is a motivational process theory that explores how individuals determine their own growth and development [3]. While emphasizing individual initiative, the theory also focuses on the dual - faceted role of the external environment—which can either facilitate or hinder individual development. Its core premise posits that autonomy, competence, and relatedness are three basic psychological needs and that they collectively influence the formation and evolution of individual motivation.

This study shifts from a traditional pathway reliant on macro-environmental transformation to a self - enhancement pathway focused on the intrinsic agency of teacher trainees. The theory posits that intelligent education literacy, as a higher-order competency, is most effectively enhanced through intrinsic motivation and ongoing personal construction. Specifically, the need for autonomy fosters the “I want to learn” motivation, which serves as the foundation for developing intelligent learning literacy. The need for competence is fulfilled within the practical cycle of "cognition-integration-reflection" which is key to developing intelligent teaching literacy. The need for relatedness, within the resource-constrained context of northwestern Guangdong, relies on resource sharing and collaborative dialogue within learning communities to provide sustained support for the development of intelligent ethical literacy. Therefore, Self-Determination Theory provides a direct and robust theoretical foundation and serves as a logical starting point for constructing the self-improvement pathway in this study.

3. Existing Problems in the Intelligent

Education Literacy of Teacher Trainees in Northwestern Guangdong

In 2025, Zeng et al. conducted a survey on the current status of intelligent education literacy among teacher trainees in northwestern Guangdong. The results indicated that the overall level of intelligent education literacy of normal school students in the northwest of Guangdong Province is above average, but there are significant gaps among various dimensions [4]. Based on analysis of the current status survey and a review of relevant literature, this study summarizes the constraining factors affecting the intelligent education literacy of teacher trainees in northwestern Guangdong.

3.1 Triple Constraints of Curriculum, Time, and Motivation on the Development of Intelligent Learning Literacy

The development of intelligent learning literacy among teacher trainees in northwestern Guangdong is primarily constrained by three factors: curriculum design, time allocation, and learning motivation. In terms of courses, the current training programs have relatively few and superficial contents related to intelligent technologies, mostly remaining at the theoretical overview level and lacking practical and operational training. Regarding time allocation, early-year teacher trainees experience "time poverty" due to heavy professional coursework and various certification exams. Upon entering their later years, they must devote substantial effort to educational internships, postgraduate entrance examinations, or civil service preparation. Consequently, systematic acquisition of AI-related knowledge and skills remains minimal throughout their undergraduate studies. At the level of motivation, some teacher trainees believe regarding motivation, some teacher trainees believe they can obtain frontline teaching jobs upon graduation, considering digital knowledge and technology non-essential for interviews or employment [5]. Although a majority of teacher trainees acknowledge the value of intelligent technologies and knowledge, they commonly perceive them as merely "beneficial but not essential". There are still certain misconceptions among teacher trainees regarding intelligent education, which are generally manifested as insufficient attention to the application and development of intelligent education, and a relatively passive understanding and use of related educational products. This is mainly due to the insufficient development of the agency of teacher trainees in intelligent education literacy and the lack of stable internal learning motivation to drive it [6].

From the perspective of the AI-TPACK theory, these challenges reveal a structural deficiency in teacher trainees' ability to construct a "technology-empowered" autonomous learning model. Due to the failure to effectively transform artificial intelligence technology knowledge (AI-TK) into learning strategies that support professional development, it shows obvious maladaptation when facing rapidly iterating intelligent technologies. This maladaptation directly hinders its quality development path of using intelligent tools to achieve self-improvement.

3.2 Lack of Practical Experience and Difficulties in Transformation Hinder the Formation of Intelligent Teaching Literacy

Janssens et al. point out point out that teaching which overlooks the educational application context of technology and severs the connection between education and technology results in teacher trainees developing only a superficial comprehension [7]. Regarding intelligent teaching, teacher trainees in northwestern Guangdong primarily face two major pain points: inadequate practical conditions and insufficient personal transformative capacity. At present, there are practical deficiencies at various levels within the cultivation of teacher trainees in China [8]. For instance, the sessions of educational observation and internship for teacher trainees are characterized by short durations and limited frequencies, which deprives them of opportunities to apply intelligent technologies in authentic teaching contexts. Meanwhile, teacher trainees have an incomplete understanding of the high-simulation training venues and intelligent equipment resources available within universities, which to some extent limits their full utilization of technical practice resources. In terms of pedagogical transformation, even when teacher trainees master fundamental intelligent technology knowledge, they struggle to effectively apply it to specific instructional designs and teaching plans. This dual constraint of absent practical experience and deficient transformative capacity severely limits the effective formation and development of

intelligent teaching literacy among teacher trainees.

3.3 Superficial Ethical Understanding Weakens Value Guidance in Intelligent Education

The intelligent ethical literacy of teacher trainees in northwestern Guangdong currently remains largely confined to the theoretical realm, with its connotations and scope understood only superficially, with an understanding of its connotations and scope that remains insufficiently deep. When confronted with technological-ethical dilemmas, some trainees demonstrate relatively weak value judgment, easily falling into the cognitive pitfall of prioritizing "technical efficiency first" [9]. In authentic application scenarios, they often focus solely on the positive effects of technology while overlooking potential risks. Relevant research also indicates that while the teaching community exhibits a considerable degree of recognition for fairness principles in intelligent education, their understanding of the involved moral dimensions remains comparatively inadequate [10]. This disconnect between theoretical awareness and practical competence restricts their capacity to exercise ethical judgment and provide value guidance in actual teaching practice.

4. Strategies for Teacher Trainees in Northwest Guangdong to Improve Their Intelligent Education Literacy

Focusing on the factors restricting the intelligent education literacy of teacher trainees in Northwest Guangdong, and referring to the three core dimensions of the theoretical mode-Intelligent Learning Literacy, Intelligent Teaching Literacy, and Intelligent Ethical Literacy-this study discusses how these teacher candidates can improve their own intelligent education literacy through a progressive "Cognition-Integrated Application-Reflection" approach.

4.1 Systematically Construct a Knowledge System and Activate Internal Learning Motivation

Intelligent learning literacy serves as the foundational competence for teacher trainees to adapt to intelligent teaching practices, directly influencing their adaptability to teaching contexts. Only when teacher trainees proactively construct learning content can they facilitate the effective absorption of knowledge and experience, which are then internalized into personal sound practices [11]. However, the current insufficiently aligned curriculum design, uneven time allocation, and lack of internal motivation have constrained the development of this literacy.

To address this issue, teacher trainees need to systematically establish a structured knowledge system in the field of artificial intelligence (AI): First, they should leverage open educational resources (OERs) for learning to compensate for the scarcity of AI-related courses in universities. Li argues that teacher trainees can proactively utilize high-quality open resource platforms such as the Smart Education of China and Chinese University MOOC to enroll in AI-related courses, thereby mitigating the shortage of AI courses offered by their institutions [12]. These open platforms aggregate top-tier teaching resources from both domestic and international sources, covering the entire spectrum of AI content from theory to practice. They enable teacher trainees to select courses based on individual needs and engage in progressive learning, thus breaking through the limitations of on-campus curricula and gradually enhancing their intelligent learning literacy. Second, develop personalized learning pathways by leveraging lightweight AI tools. For instance, teacher trainees can customize AI agents with subject tutoring or language practice functions through the Doubao App, allowing these agents to adapt to their individual learning rhythms and enable flexible human-machine interaction. Meanwhile, they should curate a collection of user-friendly and accessible lightweight AI applications to establish a mobile learning toolkit. This toolkit helps them utilize fragmented time for learning, thereby alleviating "time poverty". Finally, form intelligent learning communities through digital platforms such as Feishu and WeChat. Within these communities, members can collaboratively organize learning resources, conduct group discussions, and refine their personal knowledge systems through collective wisdom, fostering a positive mechanism of continuous learning and mutual growth. In summary, teacher trainees should always embrace the philosophy of lifelong learning, keep abreast of the practical changes that intelligent technologies bring to teaching, and explore methods for applying these

technologies to education and self-improvement [13].

Intelligent teaching literacy is the key to advancing teacher trainees' intelligent educational literacy. To effectively enhance this competence, teacher trainees should cultivate an awareness of proactive inquiry, systematically collect and organize award-winning works from authoritative competitions—such as national university micro-lecture contests and intelligent teaching competitions—as well as recordings of smart classroom practices by frontline primary and secondary school teachers, and conduct in-depth analysis of the application logic of AI technologies embedded therein. During the organization process, they can leverage note-taking tools like Notion and OneNote to classify, annotate, and analyze these cases, focusing on marking their design highlights, technology-adapted scenarios, and transferable experiences, thereby gradually constructing a personal resource library of intelligent teaching cases. Through this process, teacher trainees can develop a clear understanding of the in-depth integration of intelligent technologies and teaching, initially master the specific application methods of AI in teaching practice, and lay a solid foundation for their subsequent educational engagement. As Ding et al have argued, case observation constitutes a crucial link in the training of teacher trainees' teaching skills. High-quality case observation materials can provide them with excellent practical models for imitation, thereby enhancing the effectiveness of their autonomous training [14].

Against the dual backdrop of digital transformation and the application of AI in education, teacher trainees, as the mainstay of future teaching, will have their cognitive level of intelligent ethical literacy shape the value orientation of educational transformation. While intelligent educational tools enhance teaching efficiency, they are also accompanied by ethical risks such as data privacy breaches and algorithmic discrimination, placing higher demands on teacher trainees' ethical judgment and practical capabilities. Therefore, teacher trainees should go beyond an instrumental understanding of technology and proactively construct a systematic ethical cognitive system. On one hand, they can study policy documents such as Interim Regulation on the Management of Generative Artificial Intelligence (AI) Services (jointly formulated by seven authorities including the National Development and Reform Commission), and the Guidelines for Teachers' Application of Generative Artificial Intelligence (First Edition) (issued by the Expert Advisory Committee on Teacher Team Building, Ministry of Education of the People's Republic of China) to clarify the norms and boundaries of technological application. On the other hand, they should analyze typical cases related to "AI bias" and "data privacy" to strengthen their awareness of identifying and preventing ethical risks. When using generative AI tools, they must remain vigilant against various forms of discrimination that algorithms may entail, strictly protect students' data privacy, and uphold the principle of "education-oriented and technology-assisted." Enhancing intelligent ethical literacy not only helps teacher trainees avoid ethical risks in practical teaching and establish a correct view of technology but also supports them in building an ethical cognitive framework and upholding the ethical and legal bottom lines for the application of intelligent education, thereby promoting educational equity and integrated development in the intelligent era.

4.2 Embed into Real Teaching Scenarios and Conduct Phased Practical Training

On the basis of acquiring certain theoretical knowledge, teacher trainees need to further translate their intelligent education literacy into teaching practical capabilities, achieve the leap from cognition to application, and thus meet the requirements of the digital transformation of education. Through practical activities, teacher trainees can gain an in-depth understanding of the principles and application scenarios of intelligent technologies, thereby building a bridge between theory and practice [15].

At the practical level of intelligent learning literacy, teacher trainees can leverage tools such as ChatGPT and Ernie Bot (Wenxin Yiyan). By inputting precise prompts, they can set these tools as "debate opponents" or "Socratic questioners," and then conduct self-debates, reflective inquiries around topics like "technological empowerment and educational equity". This process helps break through mental constraints, facilitates the transfer of knowledge from comprehension to internalization, and enhances the efficiency of handling complex tasks simultaneously.

The improvement of intelligent teaching literacy

relies on the construction of simulated teaching environments. Teacher trainees can use platforms such as microteaching classrooms and smart classrooms, embed AI tutors or intelligent tools like Seewo to carry out simulated teaching, and thus achieve the transformation from resource access to practical application. For instance, with the help of "Feixiang Laoshi" (Mr. Elephant), they can generate animations, test questions and lesson plans, which strengthens classroom interactivity and teaching effectiveness. Through methods such as recorded lesson reviews and peer evaluation, teacher trainees can continuously refine teaching details and systematically improve their ability to apply intelligent technologies in classrooms.

While intelligent educational technologies are evolving rapidly, the development of relevant ethical norms and constraint mechanisms has lagged behind, making it difficult to match the actual needs of technological application. The intelligent ethical literacy of teacher trainees in Northwest Guangdong mostly remains at the theoretical cognition level and has not been effectively transformed into ethical judgment and decision-making capabilities in teaching practice. This disconnect has manifested in the training process of teacher trainees. Ou et al. pointed out that in the training of mathematics teacher trainees, there is a widespread phenomenon of "neglecting the importance of moral literacy in mathematics teaching practice" [16]. To address this issue, this study proposes the following ethical integration practice paths: First, establish a correct ethical perspective and develop ethics-first thinking habits. Teacher trainees should proactively incorporate ethical elements such as data privacy protection and AI-generated content labeling into instructional design, integrate ethical considerations throughout the entire process of teaching preparation and implementation, and strengthen teachers' moral awareness and legal bottom lines. Second, enhance ethical assessment capabilities in technological application. Teacher trainees need to be able to evaluate the compliance of AI teaching tools, identify potential risks such as infringement and privacy leakage, and possess the judgment to distinguish the authenticity of AI-generated content to prevent misleading by "AI hallucinations". Third, conduct ethical case discussions to promote the practical transformation of literacy. After systematically learning relevant laws and regulations, teacher trainees should organize seminars on real ethical cases, focus on typical ethical dilemmas in the application of AI technologies, explore the potential ethical risks of intelligent technologies under the guidance of on-site experts or senior frontline teachers, conduct reflections and sharing, and continuously evaluate and adjust training strategies [17].

Against the backdrop of the deep integration of intelligent technologies and education, teacher trainees need to be supported by internal motivation, focus on real teaching scenarios, and promote the transformation of the three core literacies—Intelligent Learning Literacy, Intelligent Teaching Literacy, and Intelligent Ethical Literacy—from theoretical cognition to practical application. These three dimensions are mutually synergistic and supportive, collectively forming a core competence system adapted to the development of "intelligence + education". This integration not only responds to the inherent logic of intelligent teaching in the new era but also provides key support for high-quality educational development and digital transformation.

4.3 Promoting Critical Reflection and Integrative Innovation for Continuous Literacy Enhancement

During the reflection and internalization stage of intelligent learning literacy, teacher trainees transition from an emphasis on "skill operation" to a focus on "critical integration." Specifically, when utilizing AI tools to assist in completing professional learning or conducting key information retrieval, teacher trainees should maintain a prudent and critical attitude towards the content generated by intelligent technologies. They need to examine the internal logical rationality, data reliability, and potential disciplinary biases of the generated results, and be capable of verifying them by referring to knowledge from different majors and related disciplines. Through a critical perspective of interdisciplinary integration, teacher trainees can transcend the constraints of merely utilizing tools and progressively cultivate a dialectical technological thinking characterized by interdisciplinary integration.

The enhancement of intelligent teaching literacy follows an "observation-practice-innovation" pathway. Teacher trainees must systematically study and analyze high-quality cases to understand their design logic and technology

integration strategies, achieving initial application by imitating. Subsequently, they engage in simulated teaching using platforms such as micro-teaching labs and reflect on improvements through peer evaluation. Ultimately, by incorporating intelligent technologies, they progressively construct and iterate personalized teaching models, completing the leap from imitation to innovation.

Intelligent technology brings teacher trainees with both opportunities for educational innovation and potential threats. Trainees must transcend the passive adherence to basic ethical norms and proactively cultivate internalized ethical judgment and value-guiding awareness. This requires them to actively participate in thematic discussions on AI education ethics during their daily study and practice, gaining a deep understanding of relevant policies, regulations, and ethical principles—particularly those pertaining to the educational process and students. Furthermore, prior to the instructional design phase, teacher trainees must engage in proactive ethical deliberation, which involves integrating privacy safeguards, AI-content labeling, and humanistic concerns into their teaching, while consistently embedding ethical awareness across all aspects of intelligent educational practice. This facilitates a role transformation from a "compliant operator" to an "ethical guardian and value leader."

The ultimate goal of this phase is to guide teacher trainees in forming a complete, closed-loop self-improvement pathway for intelligent education literacy through reflection. They should develop critical and creative thinking, utilize AI tools to understand and learn more complex educational knowledge systems, thereby completing the transformation from passive technology users to educators equipped with ethical reflective consciousness and innovative teaching capabilities.

5. Conclusion

With the rapid evolution of artificial intelligence technology, the intelligent education literacy level of normal school students is bound to play a significant role in future education and directly affects the digital capability construction of the future teaching staff. Northwestern Guangdong serves as an important region for advancing balanced educational development within the province. Consequently, improving the intelligent education literacy of teacher trainees in this area is key to strengthening the quality of Guangdong's teaching workforce as a whole. This study adopts a micro-level perspective centered on teacher trainees' self-development. It integrates the AI-TPACK theoretical framework with the developmental status of teacher trainees in northwestern Guangdong to define the foundational direction for a self-improvement pathway across three dimensions: intelligent learning, teaching, and ethical literacy. Guided by this direction, a concrete self-improvement pathway is proposed. This research not only provides an actionable self-development framework for teacher trainees in northwestern Guangdong but also offers significant reference for the professional growth of teacher trainees in similar regions. It has positive practical significance for promoting the development of regional intelligent education.

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References

[1] Ministry of Education of the People's Republic of China. The 2024 World Digital Education Conference Opens in Shanghai. Beijing: Ministry of Education of the People's Republic of China, 2024[2025-12-25].http://www.moe.gov.cn/jyb_xwfb/s5147/202401/t20240131_1113551.html(In Chinese)

[2] Mo Qianru, Yu Jiamin. AI-TPACK Theory Perspective: Development of a Model for Enhancing Teacher Trainees' Intelligent Education Literacy. Journal of Intelligence and Knowledge Engineering, 2024, 2(4):54-63.

[3] Liu Jingdong, Zhong Boguang, Si Gangyan. Application of Self-Determination Theory

in the Chinese Population. Advances in Psychological Science, 2013, 21(10):1803-1813.(In Chinese)
[4] Zeng Zhihong, Chen Yijing, Luo Xiaoyin, et al. A Study on the Current Status and Cultivation Strategies of Intelligent Education Literacy among Normal University Students in Northwestern Guangdong. Journal of Higher Education Teaching, 2025, 2(4):153-160.
[5] Yu Hongyang, Li Gaojian. Value Implication, Practical Dilemma and Improvement Path of Digital Literacy Cultivation for Teacher Trainees in the Digital Age. University, 2025, (22):106-110.(In Chinese)
[6] Wang Tianze. Research on the Current Situation and Improvement Path of Intelligent Education Literacy of Teacher Trainees in Ethnic Minority Areas. Qinghai Normal University, 2024.(In Chinese)
[7] Janssen José, Stoyanov Slavi, Ferrari Anusca, et al. Experts' views on digital competence: Commonalities and differences. Computers & Education, 2013, 68:473-481.
[8] Kong Baogang. Dilemmas and Solutions in Cultivating Teachers as Reflective Practitioners. Contemporary Educational Science, 2016(14):61-64.(In Chinese)
[9] Bai Hongli. Current Situation and Improvement Strategies of Intelligent Literacy of Teacher Trainees in Preschool Education. Learning Weekly, 2025, (34):155-158.(In Chinese)
[10]Shen Panpan. Investigation on the Current Situation of Intelligent Education Literacy of Primary School Teachers and Research on Improvement Strategies. Central China Normal University, 2023. (In Chinese)
[11]Pei Xiaojuan. A study on the current situation and improvement paths of teacher trainees' artificial intelligence literacy under the background of new normal education. Guangzhou University, 2023. (In Chinese)
[12]Li Mengxue. Research on the framework construction and improvement strategies of teacher trainees' intelligent education literacy. Hebei Normal University, 2023. (In Chinese)
[13]Chen Fangyan, Chen Li, Deng Min. Connotation, composition and improvement exploration of primary and secondary school teachers' intelligent education literacy. Educational Information Technology, 2023, (6): 3-8. (In Chinese)
[14]Ding Nan, Chen Jingyan, Jia Jiahe, et al. Framework construction and improvement paths of teacher trainees' intelligent education literacy from the perspective of artificial intelligence. Information System Engineering, 2024, (10):157-160. (In Chinese)
[15]Fang Mei. A study on the current situation of intelligent literacy of primary school teachers in Shanghai. Shanghai Normal University, 2024. (In Chinese)
[16]Ou Guiyu, Zhan Lei, Li Yundong, et al. Research on the path of improving the teaching literacy in university mathematics normal students. Frontiers in Educational Research, 2023, 6(28).
[17]Qu Xinmiao. Research on the improvement strategies of teacher trainees' intelligent education literacy. Shanxi Normal University, 2024. (In Chinese)