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Exploration and Research on the Application of Artificial Intelligence Technology in the "4 + 1" Teaching Practicum of Normal Students

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Abstract: The General Secretary pointed out that "artificial intelligence is an important driving force for the new round of scientific and technological revolution and industrial transformation, and will have a profound impact on the global economic and social development and the progress of human civilization" [1]. With the in-depth advancement of China's education reform, the training model for pre-service teachers has also ushered in changes. Based on the innovative "4 + 1" on-site (teaching) practicum for pre-service teachers at a university in Jiangsu Province, this study explores the application of artificial intelligence technology in the "4 + 1" on-site (teaching) practicum process for pre-service teachers. By using artificial intelligence technology to assist teaching design, conduct classroom behavior analysis, and generate teaching reflections, this study aims to enhance the personalization and effectiveness of pre-service teachers' internships. This research is intended to provide certain references for empowering normal education practice with artificial intelligence technology, and has positive significance for promoting the digital transformation of teacher education.

Keywords: Artificial intelligence; Normal education; "4 + 1" on-site (teaching) practicum; Practical teaching

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1. Introduction

At present, domestic normal universities continue to deepen their understanding of the concept of practical education and constantly carry out theoretical innovation and practical exploration. They have achieved good results in the practical education of pre-service teachers. However, most normal universities still attach more importance to subject professional knowledge than educational practice in the curriculum setting, and the time arranged for probation and internship is relatively insufficient, which affects the cultivation of pre-service teachers' practical ability to a certain extent. The General Secretary pointed out: "Education is the foundation of a century-long plan, and teachers are the foundation of education. Striving to cultivate a large number of first-class teachers and continuously improve the overall quality of the teaching team is an urgent task for the development of my country's education cause at present and in the future" [2]. Normal universities in the new

era shoulder the important responsibility of cultivating first-class socialist people's teachers. "The purpose of knowledge teaching is to acquire substantive knowledge through formalized knowledge—the true knowledge and wisdom inherent in the mind" [3]. The cultivation of pre-service teachers is a long-term and complex process. Educational practice is a key link in improving pre-service teachers' teaching skills, an important breakthrough in the cultivation of professional talents in normal majors of colleges and universities in the new era, a necessary path for pre-service teachers before stepping onto the podium, and also a necessary stage for pre-service teachers to transform professional theoretical knowledge into practical teaching ability.

This paper will introduce the "4 + 1" on-site (teaching) practicum model (i.e., 4 days of study at the university and 1 day of on-the-job internship at a base primary school per week) implemented by a university in Jiangsu Province in 2014. This model has effectively broken the barrier between theory and practice and has become an important measure to cultivate applied normal talents. However, in the implementation process, this model also faces some challenges, such as insufficient resources of internship schools, limited human resources of instructors, a lack of in-depth analysis and data support for lecture observation, and the need to improve the scientificity of management and evaluation in the internship process. Artificial intelligence (AI) technology, with its strong capabilities in data analysis, pattern recognition, and natural language processing, provides new ideas for solving the above problems. This paper aims to explore the possible paths for the in-depth integration of AI technology and the "4 + 1" on-site (teaching) practicum model, construct an intelligent internship support system, so as to improve the accuracy and effectiveness of pre-service teacher training, and provide a reference for the reform of teacher education in the new era.

2. Overview and reflection on the current situation of the "4 + 1" on-site (teaching) practicum model

2.1. Model overview

Educational practice is a key link to improve pre-service teachers' practical education capacity, and an indispensable teaching segment in teacher education. Its importance is beyond doubt [4]. "Educational probation" is the first link in pre-service teachers' educational practice, and also a necessary process to transform the theoretical knowledge related to education and teaching learned in class into practical educational and teaching capabilities. However, in this crucial phase, most universities tend to prioritize internships over probation, overlooking the fact that pre-service teachers need to accumulate experience through probation before internships. In terms of educational probation, most universities usually arrange 1 to 2 weeks of concentrated probation in the third or fourth year of college. This model has short duration and monotonous forms, and has no obvious effect on the training and improvement of pre-service teachers' educational and teaching skills.

In response to the problems existing in the above-mentioned traditional probation models, the "4 + 1" on-site (teaching) practicum implemented by this university is a new type of probation model for pre-service teachers. Specifically, starting from the first semester of the third year of college, pre-service teachers arrange 4 days a week to study professional education theory courses in the university, and 1 day a week to conduct probation in primary and secondary schools, kindergartens, and other relevant schools. It mainly adopts the methods of "fixed-school placement, task-driven approach, dual-mentor guidance, and timely feedback" [5]. Pre-service teachers go to the probation school on a fixed day every week, and the probation content is carried out in a progressive manner following the practical path of "observation–teaching assistance–teaching" [5]. This model changes the status quo of neglecting the probation stage and excessively concentrating probation time in the traditional practical education of pre-service teachers. It transforms the original "short, flat, and fast" model of 2

consecutive weeks of probation into a "long-term continuous" model spanning one year, allowing the probation training for cultivating pre-service teachers' professional practical capabilities to run through the entire third academic year [6]. Each probation session is carried out under the drive of specific tasks and goals, and the one-year probation achieves an organic combination of continuity and phased progress [7], which specifically solves the drawbacks of traditional probation.

Its core values are as follows:

(1) Innovative schedule arrangement: Transform probation from "short-term concentration" to "long-term dispersion" (1 day per week), realizing a continuous training model of "long-term flow without interruption."

(2) Dual-mentor system: Jointly guided by university theoretical mentors and primary school practical mentors, aiming to promote the integration of theory and practice.

(3) Task-driven approach: Set clear task lists according to probation stages (such as observation period and teaching assistance period), making the goals of probation activities clear and the content substantial.

(4) Process-oriented assessment: Conduct a full-process assessment through probation handbooks, observation records, reflection diaries, etc.

2.2. Current situation and reflection on the "4 + 1" on-site (teaching) practicum

With the changes of the times and more than ten years of implementation, the existing "4 + 1" on-site (teaching) practicum model of this university has gradually exposed the following problems:

(1) Insufficient number of internship bases. Since all pre-service teachers in the third year participate in the program, the number of pre-service teachers reaches more than 1,000 per semester. Due to time and space constraints, the "4 + 1" on-site (teaching) practicum can only be carried out in urban areas close to the university. To meet the standards of the provincial pre-service teacher professional certification (i.e., the ratio of interns to practice bases does not exceed 15:1), the number of internship bases is seriously insufficient, and it is difficult to guarantee access to schools with high-quality education and good school-running conditions [8].

(2) Low matching degree between interns and internship schools. Due to the large number of interns and diverse majors, the matching between internship schools, mentors, and interns often relies entirely on manual random arrangement. This method fails to fully consider the individual characteristics of each student, making it impossible to teach students in accordance with their aptitude and meet their personalized needs.

(3) Insufficient precision in guidance from internship schools. Due to the large number of interns and the limited number of instructors, mentors cannot track every activity of each intern throughout the process, resulting in delays in guidance and feedback. At the same time, the spatial and temporal distance between instructors from internship schools and university supervisors leads to insufficient subjective cooperation and communication in guiding students.

(4) Insufficient depth of reflection among interns. When it comes to teaching reflection, pre-service teachers participating in the internship often only stay at the basic level of completing internship tasks. They fail to conduct an in-depth analysis of key issues related to professional knowledge during the internship. This lack of reflection greatly reduces the internship effect and makes it difficult to truly improve students' teaching ability and professional literacy.

(5) Inadequate management and evaluation during the internship process. According to traditional

management methods, the actual internship process often involves a large number of paper records, and the submission, review, and organization of forms are heavy and inefficient. The process performance and interaction data between pre-service teachers and instructors cannot be fully grasped, leading to evaluation results that fail to accurately reflect the actual effect of pre-service teachers' educational practice. Thus, it is difficult to serve as a reliable basis for improving the quality of pre-service teachers' educational practice [9].

3. Exploration of the application path of artificial intelligence technology in the "4 + 1" on-site (teaching) practicum

3.1. Development trend of artificial intelligence

The in-depth integration of emerging technologies and education injects new vitality and energy into education. By promoting the development of education, it further supports the all-round development of learners. The development of big data technology, learning analysis technology, and artificial intelligence technology not only provides support for the development of educational digitalization but also improves the accuracy of resource allocation and promotes student-centered teaching reform [10].

At present, artificial intelligence technology has made major breakthroughs and has been widely applied in education, daily life, and industry. It has achieved breakthroughs in core technical fields such as computer vision, modal perception, large language models, and cognitive intelligence. Through big data and deep learning algorithms, artificial intelligence can effectively solve simple problems in daily education, life, and other environments. In the field of higher education, the wide application of artificial intelligence technology has brought new changes to the innovation of talent training models. Artificial intelligence technology has been effectively integrated into the teaching process of some courses. Through intelligent auxiliary teaching methods, it completes some basic and repetitive teaching tasks, allowing teachers to focus on the deepening and innovation of teaching content. This can effectively improve teaching quality and promote the overall level of higher education to a new stage.

3.2. Application path of artificial intelligence technology in the "4 + 1"on-site (teaching) practicum

At present, many scholars at home and abroad have tried to use artificial intelligence to assist pre-service teachers' practice. For example, Hu and others carried out pre-service teacher portrait practice relying on the intelligent training system for basic teaching skills, and Zhang and others realized intelligent recognition and recording of blackboard writing through the automatic video recording system [11]. To address the existing problems in the current "4 + 1" on-site (teaching) practicum of this university, we can introduce artificial intelligence technology into pre-service teachers' internship work. By using the artificial intelligence services already built by the university, such as DeepSeek and ChatGPT, we can conduct multiple rounds of training on important factors, including students' key information, internship school information, internship tasks, and internship evaluation, and optimize the application from the following five aspects.

3.2.1. Intelligent matching and personalized recommendation

When assigning internship schools and mentors to students, universities can comprehensively consider factors such as pre-service teachers' professional directions, skill characteristics, personal interests, as well as the advantages and faculty conditions of internship schools to achieve optimal matching. This improves the

satisfaction of both internship schools and interns from the source.

In addition, students are no longer limited by the traditional education model. They can obtain customized study plans and resource recommendations according to their own learning progress and style, thereby improving their academic performance more efficiently [12].

3.2.2. AI-assisted teaching design and practice

AI-assisted teaching can provide teachers with scientific and accurate teaching support, helping them better understand students' learning status and formulate more reasonable teaching plans and strategies [13]. By leveraging the powerful integrated natural language processing technology of artificial intelligence, intelligent agent services are provided to interns. These services include automatic lesson plan generation, optimization suggestions, and intelligent recommendation of multimedia resources for pre-service teachers participating in the internship, which reduces the difficulty of lesson preparation and improves the quality of teaching design.

3.2.3. Virtual simulation teaching

Universities with conditions can use virtual reality (VR) technology to build virtual classrooms. Before entering real classrooms, pre-service teachers can complete simulated teaching through VR technology, familiarize themselves with the teaching process, and improve their teaching ability. At the same time, relying on AI technologies such as VR and AR, it is possible to reproduce historical scenarios where educators and outstanding educational workers were respected by society, and generate AIGC cases to vividly demonstrate the professional sense of accomplishment of excellent teachers. This transforms profound theoretical resources into perceptible and acceptable positive incentives, awakening pre-service teachers' noble aspirations for the teaching profession [14].

3.2.4. AI-based classroom behavior analysis and reflection support

During the internship, pre-service teachers can use the university's AI-intelligent video recording system for simulated teaching. The system can analyze and evaluate the interns' multi-dimensional abilities during the training process, such as teaching posture, language expression, and blackboard writing, and provide objective data and feedback suggestions. This helps pre-service teachers recognize their own problems and guides them to conduct in-depth data-driven reflections.

3.2.5. Intelligent management and process-oriented evaluation

A smart management platform for the "4 + 1" on-site (teaching) practicum is built to enable online submission of interns' lecture notes, activity participation records, and reflection diaries, with the system automatically classifying and archiving the materials. Mentors can conduct online reviews and feedback through the platform. The AI system can perform sentiment analysis and topic extraction on the interns' text reflections, assisting mentors in quickly understanding their growth status and confusion to achieve efficient guidance. Finally, the platform automatically aggregates all the interns' data (videos, reports, reflections, evaluations) throughout the academic year, generating a visual personal professional growth digital file that clearly shows the evolution trajectory of their teaching skills.

4. Conclusion

Integrating artificial intelligence technology into the "4 + 1" on-site (teaching) practicum for pre-service teachers

is an innovative exploration to address the challenges of teacher training in the new era, and an inevitable path to advance the pre-service teacher training system toward intelligence, dataization, and precision. The application of artificial intelligence technology can not only effectively solve the pain points in the traditional "4 + 1" on-site (teaching) practicum for pre-service teachers, such as insufficient guidance, superficial reflection, and inefficient management, but also build an intelligent, personalized, and data-driven professional growth environment for pre-service teachers. The pre-service teachers' learning and use of artificial intelligence technology in advance during the internship will effectively improve their AI literacy and ability to teach and educate people, thereby realizing the overall improvement of the quality of future teachers. A series of exploration paths studied in this paper still need to be continuously tested and optimized in practice, but their core goal remains consistent: to empower pre-service teacher education with artificial intelligence technology, and cultivate new-era teachers who are more adaptable to future intelligent education scenarios and possess excellent teaching capabilities and in-depth reflection literacy.

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Disclosure statement

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