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Research on a Data-Intelligence-Driven "Training-Evaluation-Competition" Cultivation System for Teacher Education Students

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Abstract: The rapid development of artificial intelligence technology is driving the digital transformation of teacher education, imposing new requirements on the cultivation of teaching skills among teacher candidates in the new era. To address issues such as fragmented processes, inconsistent standards, delayed feedback, and low educational efficiency in traditional teacher training, this study takes the Teacher Training Center at Hubei University of Science and Technology as a case to establish an integrated, full-chain "training-evaluation-competition" cultivation system empowered by data and intelligence. Relying on a three-tier architecture, a four-dimensional collaborative mechanism, and a data-intelligence-based training platform, the system achieves precise skill training, intelligent competency assessment, systematic competition development, and closed-loop educational processes. Four years of practical validation have demonstrated that the system effectively enhances both the teaching competencies and competitive excellence of teacher candidates, promoting the transformation of teacher education towards digitization, precision, and systematization. Future efforts will focus on continuously optimizing platform algorithms, training resources, and talent development mechanisms to strengthen the comprehensive qualities of teacher candidates and cultivate high-quality, innovative teachers for basic education.

Keywords: Digital Intelligence Empowerment; Normal University Student; Training-Testing-Competition; Training System.

1. Introduction

The popularization of artificial intelligence and big data has propelled teacher education into a stage of digital and intelligent transformation.In the new era, the requirements for teachers' abilities are becoming increasingly diverse. Apart from traditional teaching skills, teachers also need to possess qualities such as information technology application, data analysis, teaching students according to their aptitudes, and classroom innovation.Against the backdrop of the continuous deepening of basic education reform, the shortage of normal school talents with digital literacy and innovation capabilities is becoming increasingly prominent. This has spurred local universities to innovate the skills training model for normal school students.

At present, local colleges and universities still have obvious deficiencies in the cultivation of normal students. The training, assessment, and competition links are disconnected from each other. There are issues such as inconsistent standards, loose connections, insufficient exploration of the value of competitions, lack of process data, and absence of personalized guidance. These barriers in each link not only affect the accuracy of training but also lead to lagging evaluation feedback, making it difficult to improve. The ineffectiveness of talent cultivation is impeding the overall improvement of training quality.

Digital intelligence technology offers a feasible approach to resolving the predicament of fragmented cultivation. By relying on technologies such as intelligent analysis, student situation profiling, and virtual simulation, the content and data barriers in each link can be broken down.Based on the actual situation of local colleges and universities, this paper constructs an integrated training system of "training-testing-competition" empowered by digital intelligence. Through framework reconstruction, mechanism improvement, technology empowerment, and practical implementation, it promotes the transformation of the training model towards personalized cultivation, data-based assessment, and closed-loop education, which has certain theoretical reference and practical application value.

2. The Practical Predicament of the "Training-Assessment-Competition" Training System for Normal School Students

Our school's Teacher Education Skills Training Center serves 14 teacher education programs and over 4,500 teacher education students. It has established an integrated training framework that covers training, assessment, and competition.However, due to the limitations of the traditional model, the connection and coordination among various links are insufficient, and there are obvious discontinuities. As a result, it is difficult to achieve practical results in education.

The first issue is the disconnection between training and assessment. Daily skills training focuses on routine process norms, such as lesson plan design, blackboard writing, and classroom teaching. Meanwhile, the final assessment mainly focuses on the final teaching performance. There is a deviation between the evaluation criteria of the two and the orientation of ability cultivation.In addition, traditional

manual class evaluation takes a long time, provides slow feedback, and is highly subjective. This makes it difficult for the assessment results to quickly guide daily training. As a result, the effect of promoting practice and improving quality through evaluation is greatly diminished.

The second issue is the disconnection between assessment and competition. Teaching skills competitions at all levels focus on teaching innovation, classroom interaction, on-the-spot adaptability, and advanced teaching design. The assessment standards are much higher than those of daily evaluations. However, the competition evaluation indicators have not been integrated into the regular assessment system. Students who perform well in daily evaluations often find it difficult to adapt to the innovative and stage-based assessment models of competitions. The competition selection also fails to take into account the daily academic situation, resulting in the assessment and competition operating independently, which is not conducive to the selection and stratified cultivation of outstanding students.

The last issue is the disconnection between competition and training. Competition training mostly adopts the short-term intensive training mode before the competition, lacking a systematic training plan that spans the four years of university. High-quality resources such as outstanding teaching designs, entries, and professional comments generated by the competition have not been organized and transformed into daily training materials. The competition experience cannot empower the overall teaching and training. The competition has only become a competition for a few students, and it is difficult to achieve an improvement in the overall quality of all students.

The root cause of the problem lies in three major mechanism deficiencies:First, the training objectives lack synergy. The educational directions of training, assessment, and competition are fragmented, and a unified ability cultivation system has not yet been established.Second, the student situation data are isolated from one another. Data from each link are stored independently and cannot be shared, making it difficult to support refined cultivation.Third, the overall operation mechanism is not perfect, lacking an integrated management and closed-loop optimization model that coordinates the three major links.It can be seen from this that building a comprehensive training system that runs through the entire process by leveraging digital intelligent technology and establishing a collaborative and interactive mechanism among all links is a key measure to enhance the quality of teaching skills training for normal school students.

3. Construction of a "Training-Test-Competition" Training System for Normal School Students Empowered by Digital Intelligence

3.1. Overall Framework of the Full-Chain Training System: Core Concepts of System Design

This system is anchored in three core tenets—"full-chain integration, digital-intelligence-driven innovation, and integrated practice"—to construct an intelligent, systematic, and collaborative ecosystem for cultivating the professional competencies of pre-service teachers.Full-chain integration emphasizes the removal of boundaries between core components, achieving the holistic alignment of objectives, content, data and resources to form a closed-loop operation model.Characterized by being driven by "training" (for competitions ((which serve as a validation of training) and integrated assessment-training, this transformation shifts the cultivation process from fragmented segmentation to vertical coherence.

Digital-intelligence-driven innovation serves as the core technological underpinning. By leveraging multi-modal data collection and AI-powered intelligent diagnosis, a data-driven precision education mechanism is established. This mechanism substantially shortens feedback cycles and enhances the accuracy of competency cultivation.

Integrated practice serves as the institutional guarantee. It involves developing a three-tier progressive cultivation objective system, unifying evaluation criteria, integrating educational data across the entire chain, and refining iterative mechanisms. All these measures are taken to ensure the sustainable optimization and long-term operation of the system.These three tenets are mutually reinforcing, collectively forming the theoretical framework and practical basis of this research system.

3.2. Overall Framework of the Full-chain Training System

This system establishes a three-tier progressive architecture—goal layer, implementation layer, and support layer[1]—creating a multidimensional educational framework characterized by vertical integration and horizontal collaboration. The goal layer serves as the top-level guide, establishing a tiered competency development system. The implementation layer acts as the core vehicle. It involves the integration of training, assessment, and competition. The support layer provides technological underpinning, leveraging digital-intelligent platforms to deliver intelligent empowerment throughout the entire process.

The goal layer defines a three-stage progressive objective: "basic skills → comprehensive competencies → exceptional qualities." Basic skills focus on fundamental abilities such as handwriting, speaking, drawing, lesson planning, and multimedia presentation. Comprehensive competencies emphasize teaching-related capabilities, including classroom management, teacher-student interaction, and the application of educational technology. Exceptional qualities target higher-order attributes such as teaching innovation, interdisciplinary integration, educational reflection, and research. These are aligned with the developmental patterns of normal students at different academic levels, thus providing a unified educational direction for end-to-end talent cultivation.

The implementation layer focuses on data connectivity, integrating training, assessment, and competition into a unified framework. The training module captures formative practice data; the assessment module generates diagnostic evaluation data; and the competition module produces outcome-based demonstration data. These three modules share standardized, interoperable data, enabling a virtuous cycle where training aligns with assessment, assessment supports competition, and competition in turn promotes better training. Competition feedback is fed back into training.

The support layer consists of two core components: an AI analytics engine and a data middleware platform[2]. The analytics engine uses machine learning and computer vision technologies to intelligently recognize classroom behaviors, diagnose teaching issues, and generate personalized improvement recommendations. The data middleware is responsible for collecting, cleaning, integrating, and storing multi-modal data across the entire chain, effectively eliminating information silos. Working in synergy, these two components provide essential support for intelligent operations throughout the entire process through competency profiling, process tracking, and smart decision-making.

3.3. Digital Intelligence Empowers a Precision Training System

The center is equipped with micro-teaching classrooms, smart writing training rooms, and other digital and intelligent professional training venues [3], laying a solid hardware foundation for skills training.The system adopts modular and hierarchical training content, innovates diverse practical training forms, and uses digital intelligence technology to conduct hierarchical, classified, precise, and personalized cultivation of teachers' training skills.

The training content adopts a modular combination and hierarchical progressive design. Horizontally, it is divided into four major modules: teaching design, simulated teaching, and technology application. It not only provides specialized training but also enables comprehensive practical training, precisely addressing the shortcomings in capabilities, along with interactive adaptability.

Vertically, a three-level training system has been established. In the first and second years, the focus is on strengthening basic skills such as writing, Mandarin, and lesson plan writing. In the third and fourth years, efforts are made to improve comprehensive abilities such as teaching, class management, and courseware production. Students preparing for competitions focus on advanced qualities such as teaching innovation, thereby achieving a gradual improvement in comprehensive qualities.The training adopts a three-dimensional integrated development model, taking into account both autonomous and centralized learning, online and offline learning, as well as individual and collaborative learning.

Digital intelligence technology is the core force supporting the precise and personalized training of normal school students' skills, effectively breaking through the limitations of uniformity and homogeneity in traditional normal school skills training. Relying on a multi-dimensional resource system including course resources, teaching cases, and practical training tools, the digital intelligence training platform can build a step-by-step and differentiated cultivation path. At present, technologies such as AI classroom behavior analysis, virtual teaching simulation, and big data student situation profiling have been widely applied, laying a solid technical foundation for the reform of teacher education skills training.The teacher education skills training room of our school integrates technologies such as virtual simulation and AI intelligent diagnosis, and combines functions such as classroom behavior analysis, teaching data profiling, and immersive simulation teaching, achieving collaborative innovation in the skills cultivation of normal students and the development of teachers' capabilities.

In terms of data collection and intelligent analysis, the digital intelligence platform can record the entire-process data of normal school students' skills training, covering multi-modal information such as micro-teaching videos, calligraphy training results, Putonghua training audio, training duration, assessment scores, and skill shortcomings. By using an AI analysis engine to intelligently disassemble and precisely analyze massive training data, it is possible to accurately identify each student's skill strengths and weaknesses, generate exclusive ability portraits and shortcoming lists, and provide scientific data support for the formulation of personalized training plans.

In terms of intelligent training adaptation, the system relies on AI diagnosis results and students' ability levels to automatically push personalized training content and plans suitable for them, achieving precise and targeted training.

For students, it rectifies shortcomings such as blackboard design, classroom script, and language expression through targeted matching. The system provides micro-lesson resources, special tasks, and intelligent error-correction tools.Meanwhile, the system can dynamically adjust the training content and difficulty according to the progress of students' skill improvement, aligning with the students' zone of proximal development and gradually promoting the precise and efficient enhancement of normal school students' teaching skills.

3.4. Human-Machine Collaborative Intelligent Assessment System

The school conducts a comprehensive skills test for normal school students every May and June and establishes an intelligent assessment system of "manual review + digital intelligence empowerment" [4]. By promoting learning and improvement through testing, the school aims to achieve the goal of enhancing quality through testing.

This assessment focuses on three core abilities: the practice of professional ethics, teaching practice, and comprehensive education. It comprehensively evaluates the essential teaching qualities of normal school students.The assessment adopts a 100-point grading evaluation method, setting four grades: excellent, good, qualified, and unqualified, to further standardize the skill evaluation standards.The distribution of assessment weights is scientific. Teaching design accounts for 20%, courseware production for 15%, simulated teaching for 50%, basic subject skills for 10%, and educational wit for 5%. This comprehensively and standardly tests the professional skills of normal school students.

The assessment is conducted based on smart classrooms and micro-teaching training venues. It utilizes intelligent technologies such as voice recognition and behavior capture to collect multi-dimensional data of classroom teaching and automatically generate quantitative scoring reports, thus avoiding issues such as subjective deviations and slow feedback in traditional manual assessment. The assessment compiles data from daily training, stage evaluations, and competition results, and constructs a digital portrait of students' abilities in a visual form. This clearly shows the strengths and weaknesses of their abilities, offering scientific support for precise practical training, stratified cultivation, and internship assignment.

This study took 35 graduates majoring in Applied Psychology from the class of 2025 as samples and conducted statistical analysis on the data of various dimensions of their teacher professional skills tests. The results show that the overall teaching skills and qualities of this batch of normal school students are good. The average score of each

assessment dimension reaches above 82 points, and the overall training quality meets the standards.Among them, the two dimensions of simulated teaching (85.09 points) and individual tutoring (86.03 points) performed most prominently. The cultivation of core educational skills achieved remarkable results, with only a very small number of students having individual tutoring scores lower than 80 points.In terms of writing skills, the standard deviations of penmanship and chalk writing are 2.89 and 2.67 respectively. The overall fluctuation is relatively small, and the scores are concentrated in the range of 80 to 86. The students' writing skills are generally balanced, but the assessment discrimination is relatively low, making it difficult to effectively identify the students' levels.

From the perspective of differentiated performance in capabilities, the characteristics of unbalanced development across various dimensions are quite evident. The standard deviation of the instructional design dimension reached 5.67, which is the highest among all dimensions. The score range is from 70 to 94 points. The phenomenon of polarization is significant, and students' instructional design ability presents a distinct feature of "stratification of strength and weakness".The standard deviation of the simulated teaching dimension is 5.23, and there are also obvious individual differences. Some students have the problem of ability mismatch, being strong in classroom presentation but weak in teaching design skills.

Compared with other dimensions, group counseling is the weak-point module of students' abilities, with an average score of only 82.20 points, which is the lowest among the six dimensions. Moreover, the low-score range is concentrated, and 78 points has the highest frequency of occurrence. This reflects the overall weakness of students' abilities in planning, organizing, and implementing group counseling, and there is an urgent need to carry out targeted specialized training. The detailed statistical data and distribution characteristics of each dimension are shown in the following table.

Table 1. Statistics of Scores in Each Dimension of the Teacher Professional Skills Test for the Graduates of the 2025 Batch of the Applied Psychology Major

Text items	Sample size	Mean	Median	Standard deviation	Minimum	Maximum	Distribution pattern
Individual tutoring	35	86.03	85	3.56	78	92	Negative bias (high score concentration)
Group counseling	35	82.2	80	3.78	78	88	Negative bias (high score concentration)
Pen writing	35	83.43	84	2.89	78	86	Negative bias (high score concentration)
Chalk writing	35	82.97	84	2.67	78	86	Negative bias (high score concentration)
Teaching design	35	84.48	84	5.67	70	94	Moderately to the left
Simulated teaching	35	85.09	85	5.23	70	94	Moderately to the left

Taking 35 graduates of the Applied Psychology major of the class of 2025 as samples, data analysis was conducted. The results showed that the average score of each assessment dimension of the students exceeded 82 points,and the overall cultivation quality was good.Among them, the individual tutoring and simulated teaching abilities were outstanding. The scores of penmanship and chalk writing were stable and balanced, with no obvious individual differences. The dimension dispersion of teaching design and simulated teaching was relatively high, and students' abilities showed polarization. Some students had the problem of ability mismatch, where their teaching design was weak but their classroom performance was outstanding.In addition, the average score of group counseling was the lowest, which was a weak point in students' core abilities. Relying on digital intelligence assessment, the differences in students' abilities can be accurately captured, providing reliable data support for the subsequent targeted reinforcement training and optimization of the training program.

3.5. A Four-level Integrated Competition and Excellence Cultivation System

The normal college benchmarks against the mainstream teaching skills competitions for normal students at the provincial and national levels, forms a special guidance team, compiles competition guidance manuals, and builds a four-level competition cultivation system that runs through the "college-university-provincial-national" levels. Among them, the college-level competition is open to all students for popularization and empowerment, aiming to discover potential talents. The school-level competition forms a talent cultivation... The motivation team is formed through the selection of the best. Provincial and national competitions are benchmarked against high-level standards to test the quality of school cultivation. Ultimately, it forms an educational pattern where "everyone can participate, there is selection at each level, and excellence is improved in a stepwise manner".

The core event data from 2022 to 2025 indicates that the effectiveness of our school's competition-based education has steadily improved.At the provincial competition level, the school has consistently won high-level awards in the Hubei Province Normal Students' Teaching Skills Competition, and the number of first prizes has steadily increased. The number of first prizes in the Hubei Province Primary Education Professional Skills Competition has risen from 0 in 2022 to 5 in 2025, indicating a significant improvement.In terms of national-level competitions, in 2025, the school won the first prize in the "Tianjiabing Cup" national competition, achieving a zero-to-one breakthrough in this event.Over the past four years, the school has maintained an average of approximately 30 awards in competitions each year, and the overall educational achievements have been steadily improving.

The system establishes a two-way integration mechanism of training and competition, integrating high-

level ability requirements such as competition innovation and interactive adaptability into daily training in advance.At the same time, high-quality competition cases, judges' comments, and competition preparation experiences are stored in the database and fed back to daily practical training teaching.Relying on the digital intelligence platform to collect data from the entire competition process, it supplements the dimensions of students' ability portraits, promotes the in-depth integration of competition links into the entire closed-loop education chain, and achieves the collaborative empowerment of "competition, training, and assessment".

3.6. Four-dimensional Collaborative Connection and Operation Mechanism

This study has established a four-dimensional collaborative connection mechanism covering goals, contents, data, and feedback, which provides support for the smooth operation of the teacher education skills training system.The goal dimension unifies the educational direction of "training, assessment, and competition". It coordinates the training plan through a three-level progressive ability indicator, effectively avoiding the problem of fragmented training goals.

The content dimension promotes the deep integration and two-way communication among the three. Training aligns with assessment norms and competition standards. Assessment guides training optimization, and competition results feed back into daily practical training, breaking the fragmented situation of "training, assessment, and evaluation".

The data dimension relies on the data middle platform to integrate various educational information, break down data barriers, and provide data support for student situation analysis, stratified cultivation, and intelligent policy implementation.

The feedback dimension forms a closed-loop iterative model. It applies the results of training summaries, assessment analyses, and event reviews to the optimization of practical training to achieve dynamic improvement of capabilities.

The four dimensions work in coordination and synergy to lay a solid operational foundation for the integrated and full-chain education model.

4. Summary of the Practical Achievements of the System

After four years of practical iteration, the digital intelligence empowerment of the "training-assessment-competition" full-chain training system has achieved remarkable educational results, realizing an all-round improvement in the quality of skills training, the level of excellence training for competitions, and the educational model and mechanism.

First, the rate of normal school students meeting the teaching skills standards has significantly increased. After the implementation of the system, the pass rate of the skills assessment for normal school students rose from 76% to 94%, an increase of 18 percentage points. The standardization and normalization levels of students' core skills, such as "three characters and two words (drawings)", courseware production, and simulated teaching, have been significantly enhanced, effectively addressing the problems of ambiguous standards, disconnection between learning and practice, and uneven quality in traditional training. The outcome-oriented educational concept has been fully implemented.

Second, there has been a dual breakthrough in both the quality and quantity of awards won in the competition. From 2022 to 2025, a total of 101 provincial and national awards were won, including 14 first prizes, 39 second prizes, and 48 third prizes. The total number of awards won in 2025 increased by 15% compared to 2022. The school has achieved a historic breakthrough in high-level awards. Winning the first prize in a national-level competition marks a leapfrog improvement in the school's ability to cultivate top-notch normal students.

Third, the education model has undergone a systematic digital transformation. Empowered by digital intelligence technology, the training model has completed three major transformations: from experience-driven to data-driven, from unified indoctrination to precise cultivation, and from fragmented links to full-chain collaboration. Relying on AI diagnosis, data profiling, and closed-loop feedback mechanisms, personalized, refined, and long-term training of normal students' skills has been achieved, and the scientificity, stability, and scalability of the system have been fully verified.

5. Conclusion

In response to the issues in traditional skills training for normal school students, such as fragmented links, inconsistent standards, delayed feedback, and low educational efficiency, this study constructs a digital-intelligence-empowered "training-assessment- competition" full-chain integrated training system.This system relies on a three-tier architecture, a four-dimensional collaborative mechanism, and a digital-intelligence training platform to achieve precise skills training, intelligent ability evaluation, systematic competition training, and a closed-loop education process.

Four years of practical verification have demonstrated that this system can effectively enhance the teaching skills of normal school students and the quality of competition training, promoting the transformation of the teacher education model towards digitization, precision, and systematization.In the future, we will continue to optimize the platform's algorithms, practical training resources, and advanced training mechanisms, and continuously enhance the comprehensive qualities of normal students to cultivate high-quality and innovative normal talents for basic education.

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