

Enhancing Teacher-training Students' Intelligent Teaching Competence: An Exploration of Teaching Reform Based on the Modern Educational Technology Course

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Abstract: Intelligent teaching has become an important trend of future basic education, and teacher-training student, as the core reserve force of future basic education, have a direct relationship with the level of their intelligent teaching competence to the promotion of intelligent education reform and the effectiveness of talent training. This study takes teacher-training students as the research subjects and employs a questionnaire survey method to analyze the overall current status of their intelligent teaching competence. It explores the influence of factors such as gender and grade level on their competence levels, and summarizes the developmental characteristics of teacher-training students' intelligent teaching competence. Ultimately, from the perspective of the Modern Educational Technology course, the study proposes targeted teaching reform strategies, aiming to provide reference for normal universities and colleges to improve their intelligent teacher cultivation systems and enhance the quality of teacher-training student development.

Keywords: Teacher-training Student, Intelligent Teaching Competence, Training Strategy

1. Introduction

With the rapidity of digital intelligence technology, the contemporary educational ecosystem is undergoing a reshaping. Changes in the education ecosystem are driving the transformation of teaching towards intelligence and personalization, which is not only reflected in the intelligent upgrading of teaching, but also in the deeper reconstruction of teaching concepts and teaching triggered by this change. As the backbone of basic education in the future, the enhancement of teacher-training student's digital literacy is not only a knocking brick for their personal careers, but also a core engine to promote the transformation of education to digitalization, the continuous enhancement of teaching and learning, and the cultivation of talents to meet the needs of the times.

The increasing abundance of digital teaching resources has provided teacher-training student with a broader platform for learning and practice. However, the average level of digital literacy and skills of most Chinese teacher-training student relatively low at present^[1]. Therefore, how to be able to effectively utilize digital resources and transform them into practical teaching skills has become a challenge for the growth of teacher-training student nowadays.

Intelligent teaching competence, a core component of teachers' digital literacy, connects teachers' professional adaptability, innovation in teaching, and future competitiveness of teacher-training student. For this reason, improving the intelligent teaching competence of contemporary teacher trainees is an important part of the educational and pedagogical activities of preparing an outstanding teacher-trainee^[2]. Without the effective development of intelligent teaching competence, teacher-training student will have difficulty adapting to the shift to an intelligent-teaching educational environment, which in turn will affect their future teaching effectiveness and their own careers.

Currently, relevant research focuses on the reconstruction and practical innovation of education and teaching in the context of digital transformation of education. For example, how can AI empower teaching and learning? Paths to bridging the digital divide between urban and rural teachers, and the construction of an evaluation system for teachers' smart teaching literacy. However, there is limited research on the digital teaching literacy required of teacher education students during the process of digital transformation, as well as on the reform of pedagogical courses in teacher education programs.

The Modernization of Education in China 2035 clearly states that modern information technology should be used to drive reforms in talent training. As the Modern Educational Technology course serves as the critical link directly connected to intelligent education competence within the teacher-training cultivation system, its teaching reform has become the core breakthrough point for implementing this strategic requirement. Therefore, conducting an in-depth analysis of the current status of teacher-training students' intelligent teaching competence, exploring effective teacher education strategies from the perspective of modern educational technology courses are of great significance for enhancing the overall quality of future basic education teaching staff and advancing the digital transformation of education.

2. Research and Design

2.1 Research Subjects

The school in which this survey was conducted was a local undergraduate institution, and a stratified sample of the school's freshman through senior teacher-trainees were administered an online questionnaire. A total of 360 questionnaires were collected and 45 were rejected, resulting in 315 valid questionnaires. There are 76 freshmen, 97 sophomores, 71 juniors and 71 seniors. There are 133 male students and 182 female students.

2.2 Research Instruments

In this study, the Digital Competency Questionnaire for teacher-training student developed by Li was used to revise the questionnaire^[3]. The questionnaire contains 4 dimensions of Competent Learning, Competent Teaching, Competent Nurturing and Competent Community, with a total of 16 question items. The questionnaire was scored on a special five-point scale from "not at all" to "completely", and the respondents scored the items according to themselves to assess their performance in terms of intelligent teaching competence.

2.3 Data Processing

SPSS statistical software was used to process and analyze the data. Descriptive statistical analysis was first used to analyze the characteristics of the current status of teacher-training student' teaching competence. Then, independent samples t-test and one-way ANOVA were used to explore the differences in intelligent teaching competence among teacher-training student of different genders, grades and to analyze the influencing factors.

3. Results and Analysis

3.1 Overall Level of Competence in Intelligent Teaching

According to the data in Table 1, it can be seen that the teacher-training student' intelligent teaching competence and its dimensions are at a low level.

Table 1 Descriptive statistics for each study variable and dimension.

Variable or dimension	<i>M</i>	<i>SD</i>
Competent-Learning	2.37	1.05
Competent-Teaching	2.44	1.14
Competent-Nurturing	2.42	1.15
Competent-Community	2.47	1.17
Intelligent Teaching Competence	2.42	1.08

3.2 The Influence of Individual Factors on Intelligent Teaching Competence

3.2.1 Gender-Based Difference Test

According to the analysis of Table 2, there is a significant gender difference in intelligent teaching competence of teacher-training student. Female teacher-trainees have significantly higher levels of intelligent-teaching competence and each dimension than male teacher-trainees.

Table 2 Gender-Based Differences in Teacher-trainees' Intelligent-teaching Competence.

Variable or dimension	Male		Female		<i>t</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	
Competent-Learning	2.10	0.94	2.56	1.08	-4.05***
Competent-Teaching	2.19	1.02	2.62	1.18	-3.51**
Competent-Nurturing	2.15	1.03	2.61	1.19	-3.67***
Competent-Community	2.18	1.04	2.69	1.22	-4.04***
Intelligent Teaching Competence	2.15	0.97	2.62	1.12	-3.99***

Note: **: $p < 0.01$, ***: $p < 0.001$

3.2.2 Grade-Based Difference Test

According to the analysis of the data in Table 3, the teacher-training student' competence in intelligent teaching varies significantly by grade level. From the post-hoc test, it can be concluded that freshman and sophomore teacher-training student had significantly lower scores on intelligent teaching competence and all dimensions than junior and senior students, while there was no significant difference in intelligent teaching competence scores between freshmen and sophomores, and between juniors and seniors. Overall, the level of intelligent-teaching competence of teacher-trainees presents a gradual upward trend with the rise of grade levels, with the most pronounced improvement from the sophomore year to the junior year, which is consistent with the phased setup of training programs in normal universities: The first and second years of college are dominated by public foundation courses and subject foundation courses, with less content related to intelligent teaching, while the third and fourth years of college will offer professional courses in educational technology and arrange educational internships and practice sessions, which will enable teacher-training student to accumulate intelligent teaching-related knowledge in systematic learning and actual teaching, and then promote competency enhancement.

Table 3: Difference Test of Intelligent Teaching Competence across Grades.

Variable or dimension	Freshmen		Sophomores		Juniors		Seniors		<i>F</i>	Post-hoc analysis
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		
Competent-Learning	2.02	0.92	2.26	1.02	2.82	1.00	2.44	1.11	8.24***	①<③, ①<④, ②<③
Competent-Teaching	2.04	0.96	2.31	1.16	2.83	1.09	2.66	1.18	7.63***	①<③, ①<④, ②<③, ②<④
Competent-Nurturing	2.00	0.90	2.31	1.15	2.84	1.12	2.59	1.24	7.92***	①<③, ①<④, ②<③, ②<④
Competent-Community	2.04	0.95	2.33	1.09	2.94	1.16	2.67	1.30	9.02***	①<③, ①<④, ②<③, ②<④
Intelligent Teaching Competence	2.02	0.90	2.30	1.06	2.85	1.04	2.57	1.15	8.69***	①<③, ①<④, ②<③, ②<④

Note: *: $p < 0.05$, **: $p < 0.01$, ***: $p < 0.001$, ①=Freshmen, ②=Sophomores, ③=Juniors, ④=Seniors

4. Discussion

4.1 Current Situation of Teacher-training Students' Intelligent Teaching Competence

It is clear from the results that the overall level of teacher-trainees' competence in intelligent teaching is low, which may be due to the following reasons: First of all, at the level of the training system, there is an obvious shortage in the supply of courses and practical links related to intelligent education. From the data, it can be seen that the mean values of the key dimensions are on the low side, which directly reflects that the teacher-training student are weak in the practical use of intelligent teaching tools, the ability to adapt to intelligent teaching and the degree of relevant teaching methods. Teaching methods are weak. The root of the problem may lie in the fact that the current curriculum system of teacher education still focuses on the teaching skills and theoretical knowledge transfer,

while the proportion of relevant courses dedicated to the concept of intelligent teaching, the application of technological tools, and the design of teaching under intelligence is relatively small, and often lacks sufficient practical links closely integrated with real teaching scenarios, which makes it difficult for teacher trainees to transform theoretical knowledge into practical operational skills. The result is that it is difficult for teacher-training student to transform theoretical knowledge into practical operation ability^[4].

Second, at the level of resources and support, some schools have insufficient teaching hardware or software resources, leading to wide variations in the opportunities for teacher-training student to access intelligent teaching resources, which in turn leads to low levels overall. This uneven distribution of resources has led to significant disparities in the starting point of learning and the conditions of practice of intelligent teaching among teacher-training student from different universities or even between different departments of the same university. Specifically, some institutions may be equipped with state-of-the-art smart classrooms, virtual simulation laboratories, and diverse intelligent teaching software platforms, providing teacher-training student with a wealth of hands-on and simulated teaching scenarios. On the other hand, some other institutions may be limited by factors such as financial investment, lagging technology updating or management concepts, and their hardware equipment is outdated, software resources are scarce, or even lack of basic intelligent teaching support. This difference in objective conditions has a direct impact on the ability of teacher-training student to have adequate and highly intelligent teaching experiences and training opportunities. When some students have difficulty in experiencing and practicing intelligent teaching tools first-hand due to resource constraints, their familiarity with the relevant technologies, their ability to apply them, and their perception and understanding of intelligent teaching will naturally be constrained. This lack of opportunity not only undermines their likelihood of skill acquisition, but also to some extent affects their confidence and motivation in improving their intelligent teaching competence, thus pulling down the average level of the teacher-training student community as a whole^[4].

4.2 Characteristics of Teacher-training Students' Intelligent Teaching Competence

In terms of gender, females have significantly higher intelligent teaching competence than males. On the one hand, compared with males, females in teaching skills courses often show a higher degree of concentration and dedication, they are more willing to invest time and energy to repeatedly practice and all kinds of intelligent teaching tools operation methods and teaching applications, this high-frequency practice is directly translated into a more solid practical ability. On the other hand, females are usually more meticulous and pragmatic than males when it comes to intelligent teaching, they will pay more attention to the details of the performance of intelligent teaching tools in the actual classroom, the convenience of the operation process, and the specific impact on the students' learning effect, and this attention to practicality and details makes their understanding of intelligent teaching more in-depth and comprehensive. At the same time, the female student group generally has a stronger willingness to accept emerging educational technologies and is more willing to try to integrate intelligent tools into their teaching design and practice, and this positive and open attitude further promotes the effective enhancement of their intelligent teaching competence.

In terms of grade level, the teacher-training student' intelligent teaching competence showed a stage-by-stage enhancement, with the first and second stages of the freshman year overall at a lower level, and then getting a significant enhancement after entering the junior year, and there was no significant difference between the senior stage and the junior year, which indicates that the junior year is the key leaping period of the teacher-training student' intelligent teaching competence. This pattern of change is highly consistent with the training arrangement of the teacher-training program: the first two years of college are dominated by basic theoretical learning, and teacher-training student are less likely to have educational practice and intelligent teaching-related content, and the ability to improve lacks support; by the third year stage, the systematic incorporation of intelligent education-related content into the professional curriculum is beginning, and at the same time, the internship practice link also gives teacher-training student the opportunity to try to apply intelligent teaching tools in real teaching scenarios and accumulate hands-on practice, so the ability will be improved significantly. Therefore, the ability will be significantly improved. The level of competence in the fourth year stage was not significantly higher than that in the third year, on the one hand, it may be due to the fact that the fourth year teacher-training student are mostly busy with graduation thesis, job hunting and recruitment, and have limited energy to devote to the enhancement of intelligent teaching competence, and on the other hand, it also reflects the lack of enhancement guidance for teacher-training student to realize further breakthrough in their intelligent teaching competence after the end of the existing

cultivation session. Overall, the teacher-training student' intelligent-teaching competency's are in line with the general law of professional competency growth, and also reflect the critical impact of the current teacher training system on them.

5. Teaching Reform Strategies from the Perspective of Modern Educational Technology Courses

To enhance the intelligent teaching competence of teacher-training students, normal universities need to establish a tiered, progressive routine cultivation system, optimize the existing talent cultivation curriculum framework, and integrate the knowledge and skill systems related to intelligent education into the core training modules for teacher-training students. In accordance with the stage-specific characteristics of teacher-training students' on-campus development and their cognitive patterns across different academic years, a graded and categorized curriculum cultivation model can be adopted, with teaching content precisely designed to align with students' developmental trajectories. For lower-grade teacher-training students (freshmen and sophomores), instructional focus should be placed on general intelligent education content, offering foundational courses such as basic theories of intelligent education and hands-on practice with mainstream intelligent teaching tools. This helps students gain early exposure to knowledge related to smart education, establish a basic cognitive framework for intelligent teaching, master fundamental technical operation methods, and compensate for the weak supply of intelligent education resources at the junior level. For upper-grade teacher-training students (juniors and seniors), priority should be given to advanced and practice-oriented courses, covering core content such as intelligent instructional design, precise learning diagnosis, and smart classroom implementation. Simultaneously, special intelligent teaching training tasks should be added in conjunction with teaching practicum components, guiding students to deeply integrate artificial intelligence technologies with classroom instruction in their respective subject areas, and continuously refine and enhance their practical intelligent teaching skills. Furthermore, institutions can leverage well-established on-campus interdisciplinary teaching platforms to coordinate faculty expertise and teaching resources from multiple disciplines including educational technology and computer science, develop interdisciplinary intelligent teaching elective courses tailored to the development of teacher-training students, accommodate students' individualized development needs, and enrich the channels for enhancing teacher-training students' intelligent literacy and teaching competence.

Secondly, the content system of the Modern Educational Technology course should be optimized to shift the core of course cultivation from singular technical tool operation training to the comprehensive cultivation of teacher-training students' overall intelligent teaching competence. At the theoretical cultivation level, the traditional course objectives should be upgraded by abandoning the cultivation orientation that emphasizes basic information technology application, and instead taking comprehensive intelligent teaching literacy as the core objective. New teaching modules such as principles of artificial intelligence in education, ethical norms of intelligent education, and regulations related to educational digitalization should be added to help teacher-training students thoroughly grasp the core principles of intelligent technologies and their practical application logic in educational contexts, while establishing scientific, standardized, and positive professional values regarding intelligent education. At the technical practice level, while retaining the teaching of basic office software applications, emphasis should be placed on expanding practical content in cutting-edge intelligent teaching technologies, covering emerging teaching skills such as AIGC-assisted instructional design, AI micro-lecture video production, and application of intelligent learning analytics tools. This should be supplemented by advanced teaching content such as educational big data mining and analysis, and development of simple intelligent teaching tools, so as to comprehensively strengthen teacher-training students' practical application capabilities in intelligent technologies. At the teaching practice level, practice-oriented course teaching modules should be constructed, incorporating practical teaching components such as intelligent teaching plan design and analysis of exemplary intelligent teaching cases. Students should be organized to engage in practical activities including intelligent lesson preparation and simulated classroom instruction, thereby effectively enhancing teacher-training students' ability to flexibly integrate intelligent technologies into the entire process of subject teaching.

Thirdly, the teaching model of the Modern Educational Technology course should be innovated to create a project-driven, human-machine collaborative blended teaching format that integrates online and offline approaches. Relying on open online platforms featuring high-quality MOOCs and digital teaching resources, the flipped classroom teaching reform should be comprehensively advanced. Before class, students should be guided to independently complete online self-study of course theoretical knowledge to consolidate their theoretical foundation. The in-class teaching phase should focus on breaking through key and difficult points, facilitating students' knowledge internalization and

competence transformation through immersive learning activities such as in-depth case discussions, group collaborative inquiry, and special teaching project training. Meanwhile, intelligent teaching platforms should be utilized to construct multi-dimensional teaching scenarios featuring teacher-student and human-machine collaboration. AI teaching assistant systems should be employed to provide real-time question-answering, intelligent learning effect assessment, and personalized learning path recommendations. Combined with virtual simulation teaching technologies, immersive smart teaching training scenarios should be established, allowing teacher-training students to repeatedly practice intelligent teaching procedures and refine practical skills in highly simulated classroom environments, thereby accumulating practical experience in intelligent classroom teaching.

Finally, the assessment and evaluation system of the Modern Educational Technology course should be improved by constructing a process-oriented and diversified comprehensive evaluation mechanism. Based on the developmental characteristics of teacher-training students' intelligent teaching competence, comprehensive intelligent teaching competence should be designated as the core assessment indicator of the course, breaking away from the traditional one-sided evaluation model that relies solely on end-of-term written examinations or single project submissions. In terms of evaluation subjects, a multi-dimensional assessment system should be established, integrating multiple evaluation methods including instructor assessment, AI-based evaluation, peer evaluation, and student self-reflection, so as to comprehensively assess teacher-training students' theoretical knowledge reserves in intelligent teaching, technical operational proficiency, and ethical literacy in education. In terms of evaluation content, increased emphasis should be placed on assessing students' ability to integrate intelligent technologies into subject teaching and their capacity for teaching diagnosis and decision-making based on educational big data.

6. Conclusion

This study finds that teacher-training students' intelligent teaching competence is generally low, with significant differences by gender and grade level. To address this, normal universities should establish a tiered cultivation system, optimize the Modern Educational Technology course, innovate teaching models, and improve evaluation mechanisms, so as to systematically enhance teacher-training students' intelligent teaching competence.

Acknowledgement

The research was supported by the following project funds: Longyan University's 2025 projects: the Longyan City Basic Education Teaching Reform Research Project (Project No.: 2025JCJY29) and the College Students Innovation and Entrepreneurship Training Program (Project No.: 202511312003).

References

- [1] Wang Tianze. *A Study on the Current Situation of Intelligent Education Literacy of Normal Students in Ethnic Regions: A Case Study of Q Normal University*[D]. Qinghai Normal University, 2024.
- [2] Zhao Yiting, Tang Yeting, Wang Fuhao, et al. *Smart Classroom Teaching Competency of Normal University Students: Conceptual Framework, Key Elements and Structural Model*[J]. *Modern Educational Technology*, 2025(3): 55-65.
- [3] Li Yumeng. *Research on the Construction and Improvement Strategies of Digital Competence Framework for Normal University Students in the Intelligent Era: A Case Study of H University*[D]. Heibei Normal University, 2023.
- [4] Wang Yuer. *Research on the current situation and training strategy of artificial intelligence literacy of normal students based on TPACK theory*[D]. Liaoning Normal University, 2024.