The Role of Information Teaching Ability of Directional Normal Students in Teaching Effectiveness: Based on the Research of Verification Model of Structural Equation Model

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Abstract: Directed teacher education students, as the main group injecting human resources into rural basic education, play a crucial role in promoting the development of information technology in rural basic education. Based on a literature review, this study takes the enhancement of the information technology teaching efficacy of directed teacher education students in the northwest of Guangdong as the point of entry for problem-solving. The research focuses on directed teacher education students who graduated from local colleges in northwest Guangdong, collects 520 valid questionnaires, and conducts a structural equation model analysis using AMOS software to test research hypotheses. The results show that information technology literacy has the most significant positive impact on information technology teaching efficacy. Information technology instructional design ability, information technology management and implementation ability, and information technology assessment and diagnostic ability are all positively related. Teacher information technology teaching ability is a crucial factor in enhancing information technology teaching efficacy, and these factors are interconnected, forming a complete framework for information technology teaching ability. Based on data analysis and interview results, this study provides recommendations for improving information technology teaching efficacy from two aspects: self-improvement and external support.

Keywords: directed teacher education students, information technology teaching ability, information technology teaching efficacy, structural equation

1. Introduction

In the 2022 meeting of the Ministry of Education's Rural Revitalization Working Group and the Rural Revitalization Promotion Meeting, Minister Huai Jinping emphasized the crucial role of educational informatization in supporting rural revitalization, considering digitization as one of the effective means of innovating rural education [1]. The 20th Party Congress report also highlighted the importance of advancing digital education development [2]. Directed teacher education students, as the primary group injecting human resources into rural basic education, are a key factor in determining the quality and effectiveness of information technology teaching in rural basic education.

According to existing research and surveys, teachers working in underdeveloped rural areas have a slow growth rate in their information technology teaching abilities, generally low information literacy levels, lack confidence and enthusiasm in applying new technology in subject teaching, and their information technology teaching abilities cannot meet the growing demands of information technology teaching. The existence of this situation negatively impacts the quality of information technology teaching in rural basic education and hinders the achievement of educational equity. A review of the literature reveals that there is relatively little research in China that combines the analysis and discussion of teacher information technology teaching abilities and teaching efficacy, especially in exploring the mechanism by which information technology teaching abilities affect teaching efficacy. Therefore, exploring the relationship between information technology teaching abilities and teaching efficacy and examining how various dimensions of information technology teaching abilities affect teaching efficacy are key to stimulating teachers' intrinsic motivation for information technology teaching abilities. This is in line with the current development needs of the field of education and teaching and has theoretical and practical significance.

2. Research Design

Based on a review of existing research, there is still no unified definition of "information technology teaching ability" among scholars. Du Yuxia defines information technology teaching ability as the ability of teachers to use information technology appropriately to design, develop, implement, manage, and evaluate teaching processes and teaching resources, with the goal of improving teaching quality and efficiency and promoting teaching reform and innovation [3]. In the interpretation of the "Teacher Information Technology Teaching Ability Standard" by Ren Youqun and others, the "primary requirements" and "developmental requirements" of the "primary and secondary school teacher competence standards" are divided into four dimensions: technological literacy, planning and preparation, organization and management, and assessment and diagnosis, with the ability to transform learning through information technology as a developmental requirement, primarily reflected in the use of information technology to support students in autonomous, collaborative, and inquiry-based learning activities under the conditions of network learning environments or corresponding equipment [4]. Given that this study aims to explore the mechanism by which directed teacher education students' information technology teaching abilities affect their teaching efficacy and ultimately proposes targeted measures to enhance their information technology teaching efficacy, information technology teaching ability is defined as the ability of teachers to use information resources and technology appropriately at various stages of the teaching process to optimize classroom teaching, driven by the "internal demand" to improve information technology teaching efficacy and the "external demand" for information technology teaching effectiveness.

In Bandura's self-efficacy theory, self-efficacy is defined as an individual's belief in their ability to perform a specific behavior or the required actions to achieve a particular outcome in a specific context [5]. According to the self-efficacy theory, teachers' teaching efficacy refers to teachers' belief in their ability to positively influence student learning, reflecting their confidence in their "capability" [6]. In the specific thematic field of information technology teaching, which is characterized by the application of information technology, do teachers have confidence in their ability to deeply integrate information technology with the curriculum to achieve teaching objectives? An increasing body of research suggests that teachers' educational and teaching quality largely depends on their teaching efficacy, and strong information technology teaching efficacy is an important factor in optimizing teachers' information technology teaching behavior, enhancing their information technology teaching abilities, and improving information technology teaching effectiveness [7]. Based on the analysis above, this study defines information technology teaching efficacy within the information technology environment as a teacher's subjective judgment of their ability to positively influence student learning

through information technology teaching design, management, implementation, evaluation, and other means at various stages of teaching.

Existing research on teachers' information technology teaching abilities and teaching efficacy mainly focuses on separate analyses of these two research factors, lacking in-depth exploration of how they interact with each other. Tianzhen Yu and Xiaofeng Zhang constructed a hypothetical model of the "impact path of teacher information technology leadership on information technology teaching efficacy," with teaching efficacy as the dependent variable, exploring the influence of internal elements of teacher information technology leadership on teaching efficacy [8]. To explore the mechanism by which teachers' information technology teaching abilities affect their information technology teaching efficacy, this study attempts to build a hypothetical research model, "the impact path of teachers' information technology teaching abilities on information technology teaching efficacy," based on self-efficacy theory and the Technology Acceptance Model (TAM), drawing on the model assumptions and validation approach of Tianzhen Yu and Xiaofeng Zhang. The study aims to focus on the following questions: (1) Can the theoretical relationships between the core elements of directed teacher education students' information technology teaching abilities and information technology teaching efficacy be confirmed through structural equation modeling? (2) If the theoretical model is confirmed, what is the degree of the effect of the core elements of information technology teaching abilities on information technology teaching efficacy?

Based on the existing research framework and considering the limitations in terms of time, resources, and manpower, this study ultimately selects directed teacher education students who graduated from local colleges in northwest Guangdong and have taken up positions or completed internships (2022 and 2023 cohorts) as the research subjects. Information technology basic literacy (ITBL), information technology instructional design ability (ITTD), information technology management and implementation ability (ITMI), and information technology assessment and diagnostic ability (ITAD) are considered as the four core components of information technology teaching abilities. These are treated as latent variables in the model, along with information technology teaching efficacy (ITTE). Building upon existing research findings, such as the Development and Validation of a Self-assessment Tool for Pre-service Teachers' Information Technology Application Skills [9], Design and Validation of a Scale for Teachers' Information Technology Teaching Competence [10], Development and Validation of a Scale for Primary School Teachers' Sense of Information Technology Teaching Efficacy [11], and Research on Teachers' Sense of Information Technology Teaching Efficacy: Concept, Status, and Strategies [6], and in conjunction with documents such as "Interpretation of Pre-service Teachers' Information Technology Teaching Competency Standards" [4] and "Standards for Information Technology Application Competency of Primary and Secondary School Teachers (Trial)" [12], the questionnaire indicators for information technology teaching competence and information technology teaching effectiveness have been designed, as detailed in Table 1.

Table 1: Dimensions of teacher information technology teaching ability and teaching efficacy questionnaire.

Primary Indicators	Secondary Indicators	Primary Indicators	Secondary Indicators
Information Technology Literacy	Routine equipment operation and problem handling Basic Information Technology	**Informatization Instructional Design Skills**	Teaching Resource Processing and Integration Student-oriented teaching activity design

Table 1: (continued).

	Use of subject teaching platform		Optimization, Improvement and Innovation Design
Informatization management and implementation capacity	Flexible Application of Informatized Teaching Models	**Informatization Assessment and Diagnostic Capability**	Personalized assessment of students using information technology
	Use of information technology means for personalized teaching		Self-perception of teaching effectiveness
	Flexible Application of Informatized Teaching Models	**Informatization Teaching Effectiveness**	Motivated by the recognition of others
			Confidence to face future challenges

3. Hypotheses and Model Construction

The Technology Acceptance Model (TAM), developed by Davis [13], builds on the basic assumptions of the Theory of Reasoned Action. TAM comprehensively considers factors such as users' perceptions, expectations, and abilities related to technology and aims to explain and predict users' acceptance behavior of information systems [14]. This model identifies two core factors influencing individual acceptance of new technology: perceived usefulness and perceived ease of use. Perceived usefulness refers to the extent to which teachers perceive that using information technology can enhance teaching performance. Perceived ease of use primarily pertains to the ease with which teachers can use information technology for teaching or the level of effort reduction it offers [15]. Based on research findings, this paper utilizes "perceived usefulness" and "perceived ease of use" to describe the self-assessment of teachers' information technology teaching abilities. Information technology teaching efficacy, on the other hand, represents teachers' cognitive beliefs and attitudes regarding their ability to effectively apply information technology to optimize classroom teaching in real teaching contexts. Behavioral attitudes refer to an individual's positive or negative emotions toward a specific behavior they engage in. Teachers' information technology usage behavior is directly influenced by their perceived ease of use and perceived usefulness of information technology [16]. Research by Edmunds and others suggests that the Technology Acceptance Model has a strong explanatory power for users' technology usage behavior: perceived usefulness and perceived ease of use both have a positive influence on usage attitude.

Based on the above review and analysis, the following hypothesis is proposed: The four core components of information technology teaching ability (information technology basic literacy, information technology teaching design ability, information technology management and implementation ability, information technology assessment and diagnostic ability) have a significant impact on information technology teaching efficacy. The impact path hypotheses are as follows:

Information technology basic literacy (ITBL) has a direct positive effect on information technology teaching design ability, information technology management and implementation ability, information technology assessment and diagnostic ability, and information technology teaching efficacy, denoted as H1, H2, H3, and H4.

It is hypothesized that information technology teaching design ability (ITTD) has a direct positive

effect on information technology management and implementation ability and information technology teaching efficacy, denoted as H5 and H6.

Information technology management and implementation ability (ITMI) are hypothesized to have a direct positive effect on information technology assessment and diagnostic ability and information technology teaching efficacy, denoted as H7 and H8.

Information technology assessment and diagnostic ability (ITAD) are hypothesized to have a direct positive effect on information technology teaching efficacy, denoted as H9.

Based on the above hypotheses, the hypothetical model diagram of the mechanism by which teacher information technology teaching ability affects information technology teaching efficacy (as shown in Figure 1), where arrows indicate "direct positive effects."
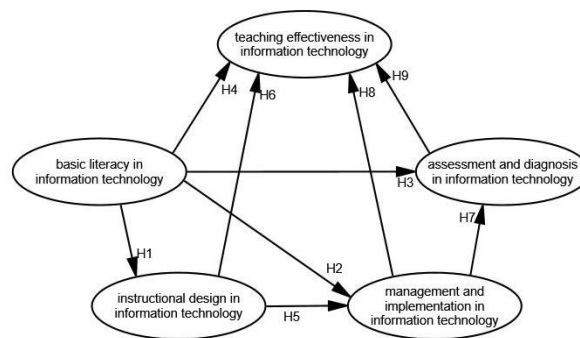
Chi-square=\cmin DF=\df Chi/DF=\cmindf GFI=\GFI AGFI=\AGFI RMSEA=\RMSEA

Figure 1: Hypothetical model of the pathways through which teacher information technology teaching ability affects information technology teaching efficacy.

4. Data Acquisition and Analysis

4.1. Data Collection

This study selected directional teacher education graduates (Class of 2022 and Class of 2023) who have graduated or have internship experience from universities in the northwestern region of Guangdong Province, China, as the research subjects. The survey was conducted on primary education majors from five teacher training institutions in Guangdong Province who have been in service for one year (Class of 2018) and those who have graduated and are about to enter the workforce (Class of 2019). A total of 535 questionnaires were distributed, and after excluding invalid questionnaires with less than 3 minutes of response time or lack of seriousness, 520 valid questionnaires were obtained. Among them, there were 268 participants from Class of 2018 and 252 participants from Class of 2019 (all with internship experience). There were 113 male participants and 407 female participants. The specific teaching subjects could be classified into three categories: arts and humanities, science, and arts and physical education. Differential statistics showed that students from different grades only exhibited significant differences in the indicator of information technology teaching application ability. Students of different genders showed significant differences in all ability indicators. Students from different teaching subjects exhibited significant differences in the indicators of information technology teaching design ability, information technology teaching application ability, and information technology teaching efficacy.

4.2. Reliability and Validity Analysis

To ensure the internal consistency of the questionnaire, internal consistency tests were conducted by calculating the reliability coefficient before conducting exploratory factor analysis. Based on the reliability test results using SPSS 22.0, the overall Cronbach's α value of the questionnaire was 0.909, and the α coefficient for each dimension ranged from 0.845 to 0.898, all exceeding 0.6, indicating a relatively high level of reliability, as confirmed by the sample data, as shown in Table 2.

Through exploratory factor analysis, a Kaiser-Meyer-Olkin (KMO) value of 0.907 was obtained, with a significance level of 0.000 (less than 0.001), indicating that the questionnaire was suitable for factor analysis. The factor loading coefficients ranged from 0.74 to 0.92, indicating that the questionnaire had good structural validity, as shown in Table 2.

Table 2: Reliability and validity analysis.

Dimension	Cronbach's α	KMO	Convergent validity		discriminant validity				
			CR	AVE	ITBL	ITTD	ITMI	ITAD	ITTE
ITBL	.884	.907	.883	.654	**.809**				
ITTD	.886	.832	.885	.660	.42***	**.813**			
ITMI	.898	.887	.897	.636	.461***	.456***	**.797**		
ITAD	.845	.711	.846	.650	.401***	.249***	.428***	**.806**	
ITTE	.894	.885	.894	.629	.476***	.365***	.442***	.411***	**.806**

Note: In the Discriminant Validity column, the bold numbers on the diagonal represent $\sqrt{\textbf{AVE}}$ (Average Variance Extracted), while the values in the corresponding rows and columns off the diagonal represent Pearson correlation coefficients. ITBL: Information Technology Basic Literacy, ITTD: Information Technology Teaching Design Ability, ITMI: Information Technology Management and Implementation Ability, ITCC: Information Technology Assessment and Diagnostic Ability.

Based on the results of the confirmatory factor analysis, the AVE (Average Variance Extracted) for each dimension in this study ranged from 0.629 to 0.660, all exceeding 0.5, indicating good structural validity of the questionnaire, as shown in Table 2. Furthermore, in Table 2, the bold numbers on the diagonal in the Discriminant Validity column represent $\sqrt{\text{AVE}}$, which are all greater than the values in the corresponding rows and columns off the diagonal (Pearson correlation coefficients). This indicates that the model has high discriminant validity, and the items within the variables are strongly correlated.

4.3. Structural Equation Model Validation

The adequacy of the model needs to be demonstrated through structural validity. Upon analysis, the model's chi-square degrees of freedom ratio was 1.594, indicating a good fit of the model. Additionally, the RMSEA (Root Mean Square Error of Approximation) value was 0.034, and all model fit indices reached the adaptation standard values, indicating that the constructed model has a good fit, as detailed in Table 3.

Table 3: Model fit indices.

Indices	CMIM/DF	RMSEA	GFI	AGFI	IFI	TLI	CFI
Adaptation Standards	<3	<0.05	>0.9	>0.9	>0.9	>0.9	>0.9
Model test value	1.594	0.034	0.948	0.934	0.983	0.981	0.983

4.4. Path Hypothesis Testing and Analysis

Based on the fit results, path analysis was conducted on the latent variables in the research model according to the model hypotheses. The model comprises five latent variables, and based on the hypothetical model, parameter significance tests and rationality checks were performed. The test results indicate that all hypothesis paths passed the significance test (C.R. > 2, P < 0.05) and the rationality test (standardized path coefficients are all positive and not too close to or exceeding 1). This indicates that the above hypothesis paths all have significant positive effects, as detailed in Table 4.

Table 4: Coefficients of direct effects of latent variables.

Paths		Direction of action		Estimate	S.E.	C.R.	P	Standardized coefficient
H1	ITBL	--->	ITTD	0.426	0.051	8.393	***	.420
H2	ITBL	--->	ITMI	0.438	0.066	6.612	***	.328
H5	ITTD	--->	ITMI	0.42	0.065	6.493	***	.318
H3	ITBL	--->	ITAD	0.356	0.073	4.904	***	.258
H7	ITMI	--->	ITAD	0.318	0.053	6.014	***	.309
H9	ITAD	--->	ITTE	0.182	0.046	4.002	***	.198
H8	ITMI	--->	ITTE	0.171	0.05	3.43	***	.180
H4	ITBL	--->	ITTE	0.333	0.067	5.008	***	.262
H6	ITTD	--->	ITTE	0.155	0.063	2.478	*	.124

Note: *** indicates P < 0.001; * indicates P < 0.05; ITBL: Information Technology Basic Literacy, ITTD: Information Technology Teaching Design Ability, ITMI: Information Technology Management and Implementation Ability, ITCC: Information Technology Assessment and Diagnostic Ability.

Parameter estimation was performed using the maximum likelihood estimation method in AMOS 22.0, and the standardized path coefficients of the model are shown in the figure below:
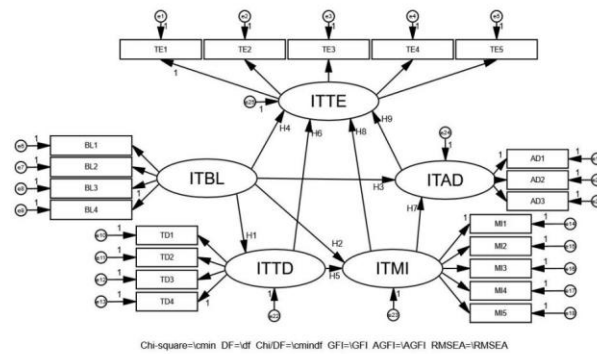
Figure 2: Standardized path coefficients of the model.

As shown in Figure 2, the path coefficients reflect the direct effects of various variables in this study, and there are also different degrees of mutual influence among latent variables. Information Technology Basic Literacy, Information Technology Teaching Design, Management and Evaluation, and Assessment and Diagnosis all have significant positive effects on Information Technology Teaching Efficacy (ITTE). The most influential factor on ITTE is Information Technology Basic Literacy (ITTL), with an effect value of 0.262. In comparison, the impacts of Information Technology Teaching Design Ability (ITTD), Information Technology Management and Implementation Ability (ITMI), and Information Technology Assessment and Diagnostic Ability (ITAD) are relatively weaker, with effect values of 0.124, 0.180, and 0.198, respectively. This does not mean that the latter three are unimportant; it highlights that Information Technology Basic Literacy is the foundation and prerequisite for Information Technology Teaching Design, Application, and Evaluation Abilities. It involves teachers' understanding and practical abilities in information technology, and a lack of solid Information Technology Basic Literacy may limit teachers' abilities to design, apply, and evaluate teaching. From the path coefficients, the direct effects of Information Technology Basic Literacy (ITBL) on Information Technology Teaching Design Ability, Information Technology Management and Implementation Ability, and Information Technology Assessment and Diagnostic Ability are 0.42, 0.33, and 0.26, respectively, indicating that Information Technology Basic Literacy positively influences these abilities. This underscores the importance of Information Technology Basic Literacy as a factor affecting these abilities. A higher level of Information Technology Basic Literacy facilitates the effective utilization of information technology in teaching design, management, and evaluation, thereby enhancing Information Technology Teaching Efficacy. This is also consistent with our earlier interview research, where many teacher candidates expressed that proficiently using educational software, online tools, and having a solid foundation in information technology literacy are essential for effective operation and management of teaching information technology. Therefore, Information Technology Basic Literacy (ITBL) has a direct and strong positive effect on Information Technology Teaching Efficacy (ITTE), which is supported by the data.

Information Technology Teaching Design Ability has a direct effect path coefficient of 0.32 on Information Technology Management and Implementation Ability, indicating that a higher level of Information Technology Teaching Design Ability has a positive direct impact on Information Technology Management and Implementation Ability. This implies that teachers with better Information Technology Teaching Design Ability are more likely to have better Information Technology Management and Implementation Ability, providing stronger support for the implementation and management of information technology teaching. Information Technology

Management and Implementation Ability has a direct effect path coefficient of 0.31 on Information Technology Assessment and Diagnostic Ability, suggesting that higher Information Technology Management and Implementation Ability is positively associated with better Information Technology Assessment and Diagnostic Ability. This helps produce effective assessment and diagnostic results, thereby improving and guiding information technology teaching practices effectively.

In summary, the positive values of the path coefficients indicate a direct positive relationship between Information Technology Teaching Design Ability, Information Technology Management and Implementation Ability, and Information Technology Assessment and Diagnostic Ability. Lack of Information Technology Basic Literacy may limit teachers' abilities in teaching design, application, and evaluation. A higher level of Information Technology Teaching Design Ability helps improve Information Technology Management and Implementation Ability and further promotes the development of Information Technology Assessment and Diagnostic Ability. The elements of information technology teaching ability are positively interrelated, forming a critical chain for enhancing Information Technology Teaching Efficacy. Thus, for teacher candidates, especially those directed to teach in underserved areas, enhancing their own information technology teaching ability is crucial.

5. Strategies and Recommendations for Enhancing Information Technology Teaching Efficacy

The analysis of the model confirms that enhancing the information technology teaching ability of teacher candidates is key to improving their information technology teaching efficacy. However, the improvement of teacher candidates' information technology teaching ability is not an overnight task but a gradual process that requires refinement at different stages of development. The development process can be summarized as follows: teacher candidates acquire theoretical and technical knowledge during their academic studies, gain practical experience during internships and employment, identify their shortcomings, continue learning relevant technologies and knowledge to enhance their skills, and ultimately achieve a continuous improvement in teaching efficacy. This process is long-term, systematic, and challenging, influenced by multiple factors, including self-improvement and external support. Based on the issues identified in the preliminary investigation, model analysis results, and interview content, we will explore strategies to enhance the information technology teaching efficacy of teacher candidates from these two aspects: self-improvement and external support.

5.1. Self-Improvement

5.1.1. The Key to Enhancing Information Technology Teaching Ability Is to Improve Information Technology Basic Literacy

In daily teaching practice, it is evident that information technology basic literacy, including routine equipment operation, problem-solving, basic information technology applications, and subject teaching platform usage, is closely related to information technology teaching design, application, and evaluation abilities. It forms the foundation and prerequisite for improving information technology teaching design, application, and evaluation abilities. The model analysis results provide scientific data support for this conclusion, and interview content also highlights the importance of information technology basic literacy. For example, in response to the question, "What are your feelings when conducting information technology teaching?" 18th-grade teacher candidate A mentioned: *"I often feel inadequate in information technology teaching. While I recognize that information technology can improve my teaching quality, I encounter many problems that I cannot address promptly when using information technology. This greatly undermines my confidence in using*

information technology for teaching design, application, and evaluation. I unconsciously avoid using information technology, and even when I must use it out of necessity, I cannot gain a good experience from it." Although new technologies are constantly emerging with the rapid development of the era, both new and old technologies have underlying logic. Teacher candidates do not need to try to master all technologies but should avoid fearing technology. Through continuous exploration, they can find technologies that work for them, actively improve their information technology basic literacy, and establish a solid foundation for teaching design, application, and evaluation using information technology, thus enhancing information technology teaching efficacy.

5.1.2. The Crucial Conditions for Enhancing Information Technology Teaching Competence: Strengthening Self-Directed Learning Abilities and Emphasizing Reflective Practice

The rapid development of technology signifies that merely relying on knowledge and skills imparted within school settings is insufficient. Targeted teacher education students, seeking to enhance their information technology teaching competence, must engage in continuous self-study. Furthermore, they must validate their learning through practical experiences. During interviews, addressing the question of whether their self-perceived information technology teaching efficacy aligns with their expectations, an 18th-grade science education student (referred to as B) expressed, *"Based on the questionnaire results, my information technology teaching efficacy is at a relatively high level, which aligns with my personal expectations. This outcome is closely related to my study habits. I frequently pay attention to educational information technology trends and enrich my knowledge base through reading papers. Throughout my time at school, I have participated in nearly every year's teacher skills competition, and the experience accumulated during these competitions has greatly assisted me".* Therefore, educational internships, teaching practicums, teacher skills competitions, micro-teaching, and similar opportunities all serve as learning platforms for targeted teacher education students. These students must prioritize each educational practice opportunity, engage in self-reflection during each instance, summarize lessons learned, continuously accumulate real-world teaching experience, and refine the course of integrating teaching and technology.

5.1.3. The Unceasing Drive for Enhancing Information Technology Teaching Competence: Breaking Free from Established Patterns, Strengthening Innovative Awareness, and Actively Encouraging Collaboration

The advent of new technologies is bound to bring about a transformation in educational models. For example, the emergence of smart classrooms based on technologies such as the Internet of Things and big data necessitates a shift from teacher-centric to student-centric approaches in the classroom. Instead of primarily focusing on knowledge dissemination in the classroom, teachers must now place students at the center of their teaching. They should utilize the support provided by new technologies to monitor and analyze students' classroom performance and tailor personalized classroom experiences accordingly.

However, the study revealed that a majority of teacher education students continue to be exposed to traditional classroom-centric teaching methods, with an emphasis on how to deliver lectures effectively. This observation was also evident during interviews. Responding to the question, "What do you think is the primary reason for your relatively low self-assessed information technology teaching efficacy?" a 19th-grade student (referred to as C) specializing in arts and physical education stated, *"In school, we are still learning outdated teaching design methods, with minimal consideration for how to employ information technology to assist teaching, let alone utilizing information technology for teaching assessment. However, when I arrived at my internship school, I noticed a seamless integration of teaching design and the information technology resources available*

at the school. I realized that information technology could significantly enhance teaching efficiency, making me more confident in my teaching. However, I currently lack these skills, which often leads to feelings of anxiety and a lack of confidence in my teaching". Therefore, targeted teacher education students should not restrict themselves to mastering traditional teaching models solely to meet school requirements. They should constantly maintain the motivation for professional development, stay attuned to emerging trends and research in educational technology, and explore novel teaching models and methods. Additionally, they should actively engage in communication with peers, students, and experienced teachers to identify their areas of improvement and chart a course for their professional growth.

5.1.4. Comprehensive Enhancement of Information Technology Teaching Competence: A Necessity for Augmenting Information Technology Teaching Efficacy

From the above analysis, it is evident that regardless of the approach taken to augment information technology teaching competence, the ultimate goal is to elevate information technology teaching efficacy. During interviews, in response to our open-ended question, "In an era of rapid information technology development, do you think teachers' information technology teaching competence is the primary reason for a perceived lack of information technology teaching efficacy?" virtually all respondents expressed agreement. For instance, an interviewee who self-assessed their information technology teaching efficacy as "good" (referred to as B) stated, *"My teaching confidence stems from my considerable acceptance and mastery of new technology. Information technology not only enhances my teaching efficiency, making my classroom more engaging, but it has also brought me numerous accolades. I have excelled in various teaching skills competitions, and my classroom performance has received positive feedback from leaders, colleagues, and students."*

Conversely, another interviewee who self-assessed their information technology teaching efficacy as "poor" (referred to as C) pointed out, *"From my internship experience, it's clear that when teachers lack relevant knowledge and skills, they feel immensely challenged and helpless. Information technology teaching requires proficiency in numerous tools and techniques, familiarity with various modern learning modes and methods"*. Thus, the key to improving information technology teaching efficacy is to enhance information technology teaching competence. Advancing information technology foundational literacy instills confidence in targeted teacher education students to explore and experiment with technology, widely employ information technology teaching platforms, and strike the right balance to maximize its impact. Concurrently, refining information technology teaching design skills enables targeted teacher education students to leverage technological advantages, resulting in more scientifically designed and student-oriented teaching practices. Proficiency in information technology application empowers targeted teacher education students to use technology judiciously, neither underutilizing nor overwhelming their teaching with technology, making it a powerful tool to enhance teaching quality. Lastly, improving information technology teaching assessment skills helps targeted teacher education students better evaluate student comprehension, promptly adjust teaching strategies, and adeptly address issues encountered in the classroom. Targeted teacher education students should regularly self-assess their information technology teaching efficacy, identify reasons for perceived low or high efficacy, capitalize on strengths, gradually transform weaknesses into strengths, and continuously enhance their information technology teaching competence to maintain high information technology teaching efficacy.

Enhancing the information technology teaching efficacy of targeted teacher education students is not solely dependent on their efforts; substantial support is also required from external factors such as the government, universities, and teacher-training institutions.

5.2. External Support

5.2.1. Provision of Advanced Information Technology Equipment and Resources on Hardware, and Optimization of Curriculum on Software

The quality of infrastructure and curriculum design at both universities and schools where targeted teacher education students are employed significantly influences their potential for developing information technology teaching competence and, consequently, enhancing information technology teaching efficacy. During interviews, in response to questions about the level of external resource and equipment support in their teaching practice—covering aspects such as software, hardware, and the overall educational environment— an 18th-grade humanities student (referred to as A) noted, *"The scarcity of software and hardware resources can hinder both my learning and teaching experiences. For example, outdated equipment within the university limits my ability to have a satisfactory learning experience, particularly concerning information technology teaching competence-related courses. Even after completing these courses, I often remain uncertain about how to effectively implement information technology teaching methods. Moreover, when I am employed, schools face financial constraints, making it challenging to invest in the latest educational equipment. Additionally, training opportunities are limited, reducing chances for further learning and skill development. These constraints hinder my ability to leverage information technology in teaching and lead to feelings of professional inadequacy.* Therefore, both universities nurturing teacher education students and the schools where these students eventually teach should focus on enhancing educational infrastructure, creating conducive learning and teaching environments, and ensuring robust support for the development of information technology teaching.

5.2.2. Strengthening Exemplar Guidance and Providing "Trailblazers" for Targeted Teacher Education Students in Information Technology Teaching

During their time in school, targeted teacher education students can be assigned experienced mentors to guide their growth in the field of information technology teaching. These mentors should not only subtly integrate information technology teaching into their classrooms, prompting targeted teacher education students to pay sufficient attention to their information technology teaching abilities, but also set gradual goals for these students in stages to enhance their information technology teaching abilities progressively. When targeted teacher education students officially begin their careers, their employing schools can adopt a "mentoring the new" model to assist them in improving their information technology teaching abilities, facilitating the transition from student to teacher roles. Consequently, the competence level of targeted teacher education students can better equip them for teaching roles, further elevating their information technology teaching efficacy.

6. Conclusion

This paper has explored the impact mechanism of targeted teacher education students' information technology teaching competence on information technology teaching efficacy. Through structural equation model analysis, it was found that information technology foundational literacy has the most significant impact on information technology teaching efficacy. Moreover, teachers' information technology teaching competence is a crucial factor in enhancing information technology teaching efficacy. Therefore, enhancing the information technology teaching competence of targeted teacher education students is an effective approach to promoting the development of information technology in rural basic education. The research results provide meaningful references for the development of information technology in rural basic education and the enhancement of targeted teacher education students' information technology teaching competence. Additionally, the study revealed that teachers'

perception of information technology teaching efficacy has a certain moderating effect on the relationship between various elements of information technology teaching competence. In the future, further exploration can be conducted on the impact mechanism of teachers' perception of information technology teaching efficacy on information technology teaching competence, as well as how self-improvement and external support can enhance the information technology teaching competence of targeted teacher education students, thus further elevating their information technology teaching efficacy.

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