TEACHER INTERNSHIP STUDENT IMPROVEMENT STRATEGY DEVELOPMENT ON TPACK TEACHING PRACTICE

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Thesis Title Teacher Internship Student Improvement Strategy Development on TPACK Teaching Practice

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ABSTRACT

The information age has introduced new requirements for teachers' information-based teaching ability. Teacher education students are the future educators, and improving their TPACK ability is crucial for advancing educational informatization. The purpose of this research is to improve the TPACK ability of primary school teacher internship student through training during the educational internship stage. To this end, three objectives are proposed: 1) To explore the current problem of TPACK ability for teacher internship students. 2) To develop strategy of TPACK ability for teacher internship students. 3) To evaluate the improvement strategy of TPACK ability for teacher internship students. The population and sample group were 55 junior college teacher education students at a normal university in Guangxi who were in the internship stage, and the research was conducted during the period from early March to early May in 2024.

Employing literature review to understand TPACK ability level of Chinese teacher education students, analyze and summarize the internal and external factors affecting TPACK, and design two TPACK ability test papers for pre-test and post-test purposes. The pre-test evaluates the TPACK ability of the research subjects, while the post-test evaluates the effectiveness of the TPACK improvement strategy. A targeted TPACK improvement strategy is designed through literature research, this strategy is implemented among the sample.

The results revealed the following:

Firstly, The TPACK ability of teacher internship students in primary school Chinese are at a poor level. The highest score is 66, the lowest score is 32, and the

average score is 48.3. The correctness rate of the TK dimension is only 30.5%, which is the lowest, and the correctness rate of the TCK dimension is the highest, which is 61.0%.

Secondly, Literature analysis indicates that TPACK ability of teacher internship students are influenced by both internal and external factors. Develop TPACK improvement strategy based on literature findings. The improvement strategy includes the consolidation of the intrinsic influences of TK, CK, PK, and the integration of TPK, TCK, PCK, and TPCK, and the extrinsic influences of excellent teacher observation and reflection on teaching.

Thirdly, After being trained in the educational internship stage, TPACK ability of teacher internship students in primary school Chinese have been significantly improved. The highest score is 94, the lowest score is 39, and the average score is 60.4. The percentage of correctness for all dimensions increased to varying degrees, especially for the TK dimension, increase from 30.5% to 58.1% on the pre-test.

Keywords: Primary school Chinese, Teacher Internship Students, TPACK, Improvement Strategy, Teaching Practice

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Chapter 1
Introduction

Rationale

Since the 21st century, the Chinese government has attached great importance to education informatization and has issued a series of documents to deploy this work: The Ten-Year Development Plan for Education Informatization (2011-2020) requires that the level of integrated development of information technology and education should be significantly improved by 2020; The National Medium and Long-term Education Reform and Development Plan (2010-2020) clearly states that it is necessary to strengthen the application of information technology and improve teachers' application level of information technology; and the National Education Development "Thirteenth Five-Year Plan" emphasizes that it is necessary to Promote the modernization of education through educational informatization, actively promote the integration and innovative development of information technology and education and encourage teachers to use new technologies to improve teaching levels and innovate teaching models. Therefore, it can be said that in the information age environment, how teachers effectively integrate technology into teaching activities has become a key issue (Ren, 2015).

As the preparation force for future teachers, teacher education students' information-based teaching ability will directly affect the quality of future education and should be well trained in the pre-service stage to adapt to the new requirements for teachers in the information age (Ren et al., 2018).

Technological Pedagogical and Content Knowledge (TPACK for short) is a kind of compound knowledge formed by the complex interaction of three core knowledge: TK, PK, and CK (Ma, 2021). It plays an important role in improving students' learning effectiveness and improving teachers' teaching quality (Srisawasdi, 2012), is of great significance to education in the information age and is an essential ability for future teachers (Chen, 2015). Effectively improving teachers' TPACK level is an important component of the educational informatization process (Zhang et al., 2015). Therefore, improving the TPACK level of teacher education students is of great significance to promoting education informatization and deserves the attention of researchers.

At present, there are still many problems in TPACK for teacher education students in China. From the perspective of internal factors, whether it is the single knowledge TK, CK, PK combined by TPACK, or the composite knowledge PCK, TCK, TPK and TPCK, there are many problems: TK lacks systematisms and foresight and cannot adapt to the development and application of new technologies; CK lacks depth and breadth and cannot meet the needs of interdisciplinary integration; PK lacks innovation and flexibility and cannot adapt to multiple interactions and personalized learning requirements; PCK lacks pertinence and effectiveness and cannot meet the direction of the new curriculum standards; TCK lacks richness and diversity and cannot make full use of digital resources and tools; TPK lacks accuracy and adaptability and cannot support personalization and precision and adaptive learning; TPACK lacks innovation and integration ability and cannot achieve effective integration of artificial intelligence and other technologies with education and teaching (Ma, Li & Yu, 2023), and the lack of a systematic, coherent, and in-depth TPACK knowledge structure (Zhang, 2020); From the perspective of external factors, the problem of TPACK for teacher education students is also reflected in the lack of effective training models and curriculum settings in schools (Zhang & Wang, 2016), lack of effective TPACK evaluation and feedback mechanisms (Ma, 2021), lack of timely, accurate, and diverse TPACK capability measurement method (Zheng, 2019), lack of effective TPACK improvement strategy and practice opportunities (Cui, 2018), and lack of proactive, creative, and reflective TPACK development process (Zhang, 2019) etc.

TPACK is a skill that develops in practice, and the education internship stage is the most concentrated period for teacher education students to combine theory and practice, it is also the best period to develop and test teacher education students' TPACK ability, the greatest impact of educational internships on the development of subject-specific teaching knowledge for teacher education students (Lang, 2020). Therefore, this study will take primary education junior college teacher internship students from a normal university in Guangxi as the research subject, and take the teaching practice of primary school Chinese course as an example, through testing the TPACK level of the teacher education students before the internship and analyzing the literature, to put forward the effective TPACK development strategy, organizing and implementing the strategy throughout the internship stage. Finally,

testing the TPACK level of the teacher internship students again after the internship, and an expert CIPP assessment was conducted to validate the effectiveness of the strategy.

Research Questions

What strategy is effective in promoting teacher internship students' TPACK development?

Objectives

1) To explore the current problem of TPACK ability for teacher internship students.

2) To develop strategy of TPACK ability for teacher internship students.

3) To evaluate the improvement strategy of TPACK ability for teacher internship students.

Scope of the research

Time-frame of the study: The time-frame of this study is only for the educational internship conducted by junior college teacher education students of a normal university in Guangxi before graduation. The duration of the internship was about 8 weeks. The educational internship was conducted while the teacher education students were completing their college studies. After all the courses were completed, comprehensive training of teaching ability and classroom management ability was conducted in primary school.

Scope of the research perspective: This study focuses on the improvement of TPACK by teacher education students during the education internship. There are two reasons for choosing this component as the focus of the study. First, TPACK is a core literacy that modern teachers should possess, emphasizing the need for teachers to have both technological, pedagogical, and subject matter knowledge in order to effectively teach the course, integrate technological tools and resources, and improve students' learning outcomes. Secondly, the education internship is the best time to test and improve teacher education students' TPACK. During this time, teacher education students have the opportunity to apply the theoretical knowledge they have learned in the university of education to actual classroom situations, and

gradually develop better teaching skills and knowledge integration abilities.

Scope of the Study: Considering that the same technology often has different usage methods and purposes in different subjects, this study takes primary school Chinese courses as an example and mainly discussing the educational internship stage, the researcher improves the TPACK ability of teacher education students by developing feasible and appropriate strategy. Therefore, the TPACK ability test in this research is aimed at primary school Chinese teaching, and the development strategy proposed are also targeted in primary school Chinese course.

Time

This study starts from early March to early May in 2024, the second semester in this academic year.

Advantages

This research is beneficial to teacher education students improve their teaching skills so that they can better cope with teaching challenges. It will enhance their employment competitiveness in the field of education in the future.

This research is helpful for teachers responsible for organizing educational internship. By studying the TPACK development strategy, teachers can better assist teacher internship students in improving their TPACK ability, thereby enabling them to better adapt to the needs of the digital education era and improve their teaching ability and quality.

This study may effectively assess the TPACK ability of primary school Chinese teacher education students with developed two TPACK test papers. Compared with other TPACK measurement methods, Test is a time-saving, labor-saving and relatively reliable TPACK ability measurement tool.

This study developed a training course will be used as a reference for primary school Chinese teacher education students in other normal universities, and can also be used as a reference for TPACK ability improvement strategy for teacher education students in other disciplines.

Definition of the Terms

Teacher internship student: It is a special stage of teacher education students in which they have completed all the courses prescribed by the university or college and are arranged by the university or college to carry out actual educational work or teaching practice experience in education internship bases (primary school) with the aim of giving them the opportunity to apply the knowledge and skills acquired during their school years as well as to gain practical teaching experience and classroom management experience, and teacher education students at this stage are referred to as internship Teachers. In China, educational internships are generally arranged in the last year of university, i.e., undergraduates organize educational internships in the fourth year of university, and junior college students organize educational internships in the third year of college. The time of educational internship (including educational apprenticeship) during the whole university period is not less than one semester (about 16 weeks), and in order to ensure the effect of internship, it is mainly carried out in the form of concentrated internship. In this study, the research subjects were junior college students majoring in elementary education at a normal university in Guangxi, and their educational internship was arranged in the second semester of the third year of the college for a period of eight weeks, and all 55 junior college teacher education students were assigned to a primary school in the rural where the college was located.

TPACK (Technological Pedagogical And Content Knowledge): It is a concept in the field of education that represents the intertwining of technology (T), Pedagogy (P) and subject matter (C), and is a theoretical framework proposed to support effective educational teaching and learning, where teachers need to synthesize all three types of knowledge in their educational teaching practice to best support student learning. Rather than pointing to the static TPACK framework knowledge of teacher internship students, this research explores the dynamic TPACK practice performance of teacher internship students, i.e., their ability to select appropriate modern information technology according to the actual teaching and learning contexts in their teaching practice and their ability to characterize the content with the help of information technology at the appropriate teaching and learning moments for the purpose of assisting the target audience of their teaching (primary school students) to comprehend and understand the content of the teaching and learning.

Teaching practice: It is an important way to enhance the teaching practice of teacher education students. In the university where the research subject is located, internship students are required to engage in teaching work practice such as lesson preparation, lesson plan design, classroom materials production, trial lectures, classes, listening and evaluation of classes, after-class tutoring, correction of homework and evaluation, examination and grade assessment, etc., under the guidance of supervisors of the internship schools and the lead teachers of the university, and each teacher internship student is required to complete at least 10 sessions of primary school listening tasks and at least 12 sessions of primary school teaching tasks during the internship period.

Constructivist Theory: A complex social theory that emerged in European and American countries in the 1980s, emphasizing that learners build an understanding of the world through active participation and construction of knowledge and experience. In this study, constructivist theory provided a framework to help student teachers better understand and apply TPACK. Through active observation, cooperative learning, reflective practice, and exploratory learning, teacher education students can improve their TPACK ability and thereby provide more effective education to primary school students.

Teacher reflection theory: This theory sprouted in the 1980s and was proposed by American educationist David Schön. The theory emphasizes that teachers' reflection and self-evaluation in teaching practice are crucial to improving teaching quality. The core claim of this theory is that by reflecting on their own teaching experiences, teachers can better understand the educational process, student needs and teaching goals, and can continuously improve their teaching methods. In this study, the focus is on teacher internship students' reflections on the information-based teaching ability of outstanding primary school Chinese teachers, in order to improve their TPACK ability.

Cooperative learning theory: Cooperative learning emerged in the United States in the early 1970s and is a creative and effective teaching theory and strategy. It has achieved remarkable results in improving the social and psychological atmosphere in the classroom, improving students' academic performance on a large scale, and promoting students to develop good non-cognitive qualities. It has been hailed as the most important and successful teaching reform in the past ten years.

Cooperative learning emphasizes interaction and cooperation among students in teaching, and promotes cognitive development and learning outcomes through joint construction of knowledge. Inspired by the cooperative learning theory, this study set up a large number of group discussions and teaching experience sharing among peers when formulating strategies to improve the TPACK abilities of primary school teacher internship students.

Research Framework

The research framework is as followed:

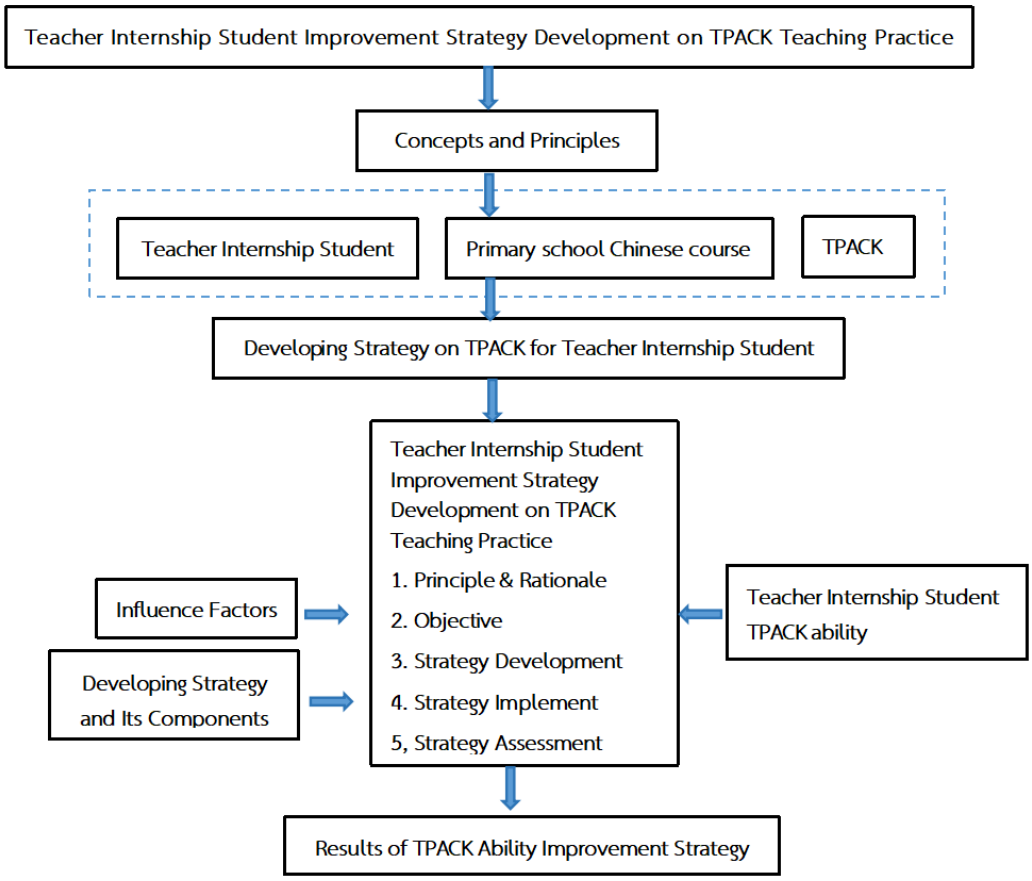


Figure 1.1 Research Framework

Chapter 2
Literature Review

In the study of "Teacher internship student improvement strategy development on TPACK teaching practice", the researcher studied the documents concerning the following.

1. Technological pedagogical and content knowledge (TPACK)
2. Teacher internship student
3. Sampling methods
4. Research instrument
   - Test papers
5. Assessment method
   - Expert assessment method
   - CIPP assessment method
6. Strategy development
7. Related research

The details are as follows.

Technological pedagogical and content knowledge (TPACK)

Since the concept of TPCK was proposed in 2005, scholars have made fruitful research on it, and through combing and summarizing the literature, we found that the research mainly focuses on three major aspects: firstly, research on the conceptual connotation, theoretical model, and measurement tools of TPACK; secondly, research on the influencing factors and developmental strategy of TPACK; and thirdly, research on the application of TPACK in different disciplines, application research in different educational stages. Moreover, in terms of the timeline of TPACK research, before 2010, the main focus was on proposing the concept and its practical application in teacher education programs, as well as more in-depth interpretation, clarification and even development of its conceptual framework; after 2010, the characteristics, developmental methods, and measurement of TPACK for teacher education students began to be emphasized, and is increasingly being used in practice in teacher education programs and in the process of preparing teacher

education student (Deng, Li & Luo, 2018).

1. Conceptual connotations, theoretical models and measurement tools of TPACK

In 2005, Mishra and Koehler of Michigan State University, USA, for the first time formally proposed the concept of integrating technological knowledge into pedagogical knowledge of disciplines, based on the concept of PCK (Pedagogical Knowledge of Disciplines) advocated by Prof. Shulman (1986), which led to the formation of the TPCK (Technological Pedagogical Content Knowledge) concept. In order to make it easier to spell and memorize, In 2006, after extensive consultation by the AACTE Innovation and Technology Committee, "TPCK" was changed to "TPACK" (Technological Pedagogical And Content Knowledge), which is easier to spell and memorize. A new name that maintains the meaning of the original concept and has been widely used since then.

In 2008, *Integrating Technology for Disciplinary Pedagogical Knowledge: an Educational Handbook* discussed in detail the concept of TPACK, the seven constituent elements of TPACK (including technological knowledge, pedagogical knowledge, content knowledge, etc.), the integration of specific disciplines, and the relevance of TPACK to teacher education and professional development. This book provides an important theoretical foundation and guiding principles for the field of education (He, 2012; Wang & Tang, 2017).

According to Mishra and Koehler, TPACK refers to the integration of TK, PK, and CK that teachers need to master in the teaching process. The teaching practice of integrating technology is not to think about the three basic elements in isolation, but to systematically pay attention to the interaction between them. The basis of the framework is to understand that teaching is a highly complex activity that simultaneously focuses on multiple types of knowledge and explores their interaction.

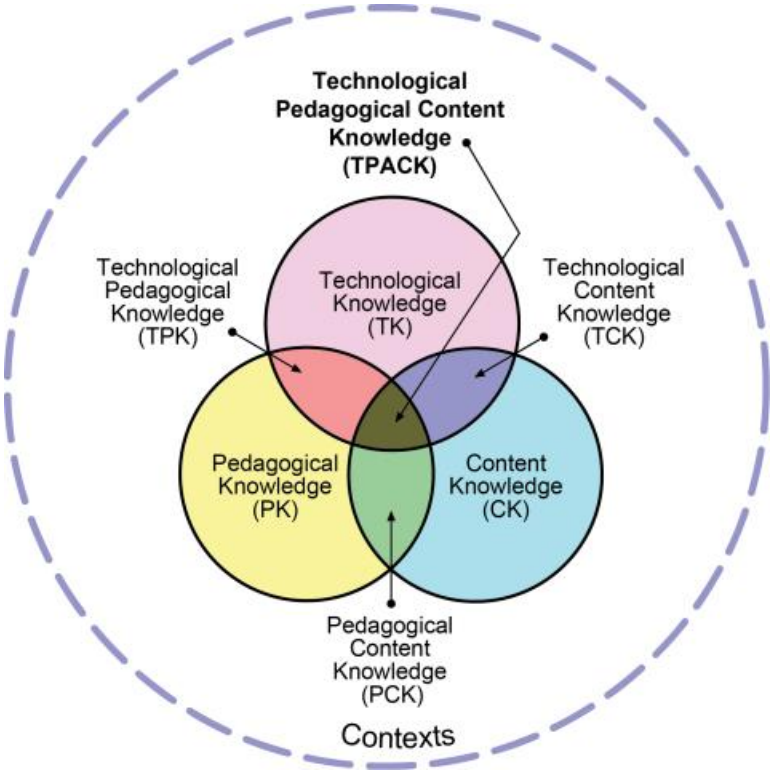


Figure 2.1 The TPACK framework and its knowledge components according to Mishra & Koehler (2006) and Mishra & Koehler (2008)

The following is the definition of TPACK components, as found in Table 2.1.

Table 2.1 The definition of TPACK components according to Mishra & Koehler (2006)

TK	Technological knowledge	Knowledge about standard technologies, such as books, chalk and blackboard, and more advanced technologies, such as the Internet and digital video.
PK	Pedagogical knowledge	Deep knowledge about the processes and practices or methods of teaching and learning and how it encompasses, among other things, overall educational purposes, values, and aims.
CK	Content knowledge	Knowledge about the actual subject matter that is to be learned or taught.
TPK	Pedagogical knowledge of integrated technology	Knowledge of the existence, components, and ability of various technologies as they are used in teaching and learning settings, and conversely, knowing how teaching might change as the result of using particular technologies.
TCK	Content knowledge of integrated technology	Knowledge about the manner in which technology and content are reciprocally related.
PCK	Pedagogical Knowledge of integrated content	Similar to Shulman's idea of knowledge of pedagogy that is applicable to the teaching of specific content. This knowledge includes knowing what teaching approaches fit the content, and likewise, knowing how elements of the content can be arranged for better teaching.
TPACK	Pedagogical knowledge and Content of integrated technology	An emergent form of knowledge that goes beyond all three components (content, pedagogy, and technology)
Contexts	Contextual knowledge	A dynamic, contextual knowledge domain interacting with content, pedagogy, and technology knowledge, varying uniquely for each teacher based on experience and philosophy.

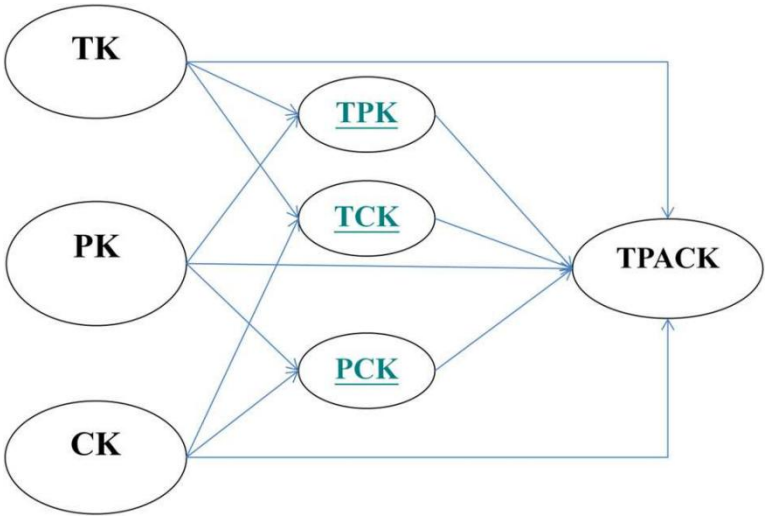


Figure 2.2 Structural model of the interrelationships among TPACK constructs (Chai, et al., 2011)

Koehler and Mishra proposed the TPACK model in 2006, which has aroused the interest of scholars around the world and produced a number of research results. Li & Li (2008) first introduced the TPACK concept to China and explained in detail the elements of the TPACK framework and their interrelationships.

In recent years, although the TPACK conceptual model has been widely used in the field of teacher professional development, there are still many unclear aspects related to its structure and theory. The TPACK model looks simple, but it cannot reflect the internal complexity of knowledge, and lack of precise definitions of the elements themselves and of the interactions between them (Graham, 2011), and there are limitations such as vague concepts, weak theoretical foundations, and difficulties in evaluation and measurement (Ruan & Yang, 2014).

Many scholars have verified the TPACK structural model had different results. For example, one study used exploratory factor analysis and found that TPACK only contains five components: TK, PK, CK, TPK and critical reflection knowledge (Koh, 2010); the TPACK of senior-year teacher education students is comprised of five elements: TK, CK, PK, PCK, and TPACK (Duan, Yan & Yu, 2016). Due to the ambiguity of the TPACK theoretical framework itself, many scholars hope to enhance its applicability by expanding its theoretical framework: Ruan expanded the TPACK theoretical framework from a macro perspective into a discipline that

integrates technology and learning strategy knowledge TSACK and disciplinary and methodological knowledge integrating technology TMACK (Ruan & Yang, 2014). Zhao et al (2015) and others proposed the "TPACK-TAM" model based on the technology acceptance model (TAM) perspective. Xu et al (2015) believed that two factors, constructivist teaching beliefs and teachers' design innovation quality, should be added to the TPACK framework to form a nine-factor structural model of TPACK. In short, the academic community has not reached consensus on the connotation of the TPACK structural model. If there is no in-depth research on the integration mechanism of technology, content, and teaching methods, and the TPACK label is used broadly and vaguely, it will easily cause its own "weakening of theoretical significance and emptying of practical guidance" (Zhang, 2014). Moreover, the specific process of TPACK in specific technologies, disciplines, teaching environments or cultural backgrounds also needs to be further explored (Deng, 2018).

Different researchers have interpreted the nature of teachers' subject matter pedagogical knowledge for integrating technology from different perspectives, resulting in three different conclusions about the nature of teachers' TPACK structure: the integration view, the transformation view, and the practice view (Zhang, 2016). To summarize, the integration view focuses on the interrelationships between the different knowledge factors of TPACK, but does not specify the structure (Mishra & Koehler, 2006); The transformative perspective holds that teachers' TPACK is dynamic and continually transformed into new knowledge (Angeli & Valanides, 2009; Cox & Graham, 2009); the practice perspective emphasizes that teachers' TPACK is constantly disappearing and reconfiguring as they learn about and use technology, viewing it as the starting point of knowledge (Doering., Veletsianos., Scharber & Miller, 2009; Bowers & Stephens, 2011; Yeh., Hsu., Wu., Hwang & Lin, 2014).

Measurement research of TPACK ability is also an important part of TPACK research. There are five main current methods for measuring TPACK: one is the questionnaire testing method, which is a quantitative research method. The technology and pedagogical knowledge assessment questionnaire for teacher education students developed by Schmidt et al. (U.S.A. 2009) is one of the typical measurement questionnaires, and in addition, the Archambault questionnaire (U.S.A. 2009), the Graham questionnaire (U.S.A. 2009), the Chai & Koh questionnaire (Singapore. 2010; 2012), the Akman questionnaire (Turkey. 2015) and other

questionnaires have been widely borrowed and adapted; the other is the performance assessment method, which measures TPACK mainly through teacher artifacts (e.g., lesson plans, curriculum materials, classroom transcripts, etc.) or by observing external behaviors. Among them, the questionnaire test method as well as the performance assessment method are most commonly used at home and abroad; the remaining three measures are qualitative measures such as classroom observation, interviews and open-ended questionnaires.

However, there are big differences in the academic community about the objectivity and accuracy of TPACK measurement research, and many scholars believe that there are big differences in the number of questions and the form of questions in the questionnaire in quantitative research, and that the respondents' adaptability to the questionnaire affects the accuracy of the survey results. As early as 2008, Cox, through interviews with experts, argued that TPACK research is still in its infancy, and it is not appropriate to conduct quantitative measurements, and Cavanagh and Koehler (2013) corroborated this viewpoint in their study on the validity of the TPACK assessment tool, which argued that TPACK research is still in its infancy in terms of measurement. Therefore, some researchers suggest further broadening the content of assessment, such as focusing on the appropriateness of the teaching-learning environment and the embodiment of the value of the subject of learning, rather than limiting it only to the aspect of assessment of the teacher; the subject of assessment can also be the teacher's own reflection or the assessment of the teaching team, the experts, or from other departments, so as to realize the diversification of the subject of assessment; and in the way of assessment, it should be more concerned with the process of assessment rather than result-based assessment, because teachers' TPACK ability can only be fully realized and reflected in the specific teaching process. (Li et al., 2015)

2. Existing problems, influencing factors and development strategy of teachers' TPACK

Judging from the existing literature, the research subjects on problems, influencing factors, and development strategy of teachers' TPACK are divided into two categories: in-service teachers and teacher education students. In-service teachers are divided into categories such as novice teachers, mature teachers and expert teachers according to different teaching years, academic qualifications,

professional titles, etc. Due to the large differences in teaching experience and ability requirements of various types of teachers (including teacher education students), When sorting out the literature on existing problems, influencing factors and development strategies of TPACK, we focused on collecting and organizing literature related to teacher internship students or teacher education students.

Based on extensive literature analysis, we learned that many literature point to the fact that teacher education students' TPACK ability is affected by demographic factors and individual factors, internal factors and external factors.

Demographic factors and individual factors mainly explore the impact of gender, grade, school level, internship school type, student source type, professional identity, teaching beliefs, self-efficacy, computer proficiency, etc. on their TPACK ability (Huang, 2015; Qin et al., 2022; Xin, 2022; Gao et al., 2022; Zhao, 2018; Ma, 2021).

Internal factors mainly discusses the impact of the three basic factors TK, PK, and CK in the TPACK structural framework and the three composite factors TPK, TCK, and PCK on TPACK (Nie et al., 2015; Duan et al., 2016).

External factors mainly explore the impact of normal school students' instructors, education and training courses, peer teacher education students, internship environment, teaching reflection, internship length, school support and policies, and incentive mechanisms on TPACK ability (Lu, 2011; Wang & Wu, 2018; Xu, 2021; Cui, 2018; Goodwin et al., 2014; Xu, 2014; Ren et al., 2018; Wang, 2017; Nguyen, 2020; Ripka, 2021).

However, the research results in many documents are inconsistent. For example, in studies on the impact of demographic factors, some studies believe that the gender of teacher education students has no impact on TPACK (Koh et al., 2011; Nie et al., 2015; Gao et al., 2022), while some The research results are just the opposite (Qin et al., 2022; Xing, 2023); under the influence of internal factors, the predictive effect of PCK, TCK and other TK, PK, CK single-dimensional knowledge on TPACK varies in different studies and even There are conflicting results (Nie et al., 2015; Duan et al., 2016); The emergence of these contradictions itself reflects the shortcomings of the highly subjective questionnaire method as a TPACK measurement method. As for the influence of external factors, different researchers have different focuses and have proposed the influencing factors of TPACK from multiple perspectives.

In any case, TPACK is a skill developed in practice (Dai & Wang, 2022), and the educational internship stage is a critical period for teacher education students to organically combine theory and practice. Therefore, it is necessary to take measures at this stage to improve teacher education students' TPACK ability to ensure that they can integrate technology, pedagogy, and subject content more effectively in future educational practices.

3. Application of TPACK in different disciplines and stages of education

With the depth of research, the TPACK framework has been gradually introduced to specific subject areas, and scholars in China have proposed subject-specific TPACK frameworks in combination with subject-specific teaching. For example, Lesser and Groth (2008) introduced subject content knowledge into the field of statistics and constructed the "TPSK" framework. Wang (2016) introduced TPACK to explore the professional development of music teachers and proposed the TPUMK framework with the characteristics of the music discipline. Song et al (2020) developed the TPACK framework into the V-TPACK framework used by vocational teachers by combining the competency needs of vocational education teachers. In order to better adapt teachers to the needs of the AI era, Yan (2020), Yu (2022) and others constructed AI-TPACK, a subject teaching knowledge model that integrates AI technology. Duan et al (2016) investigated the current status of TPACK development of junior high school mathematics teachers, and finally constructed the five dimensions of junior high school mathematics teachers' TPACK level development sequence. On the basis of foreign studies, Zhang (2016) analyzed the five main factors of TPACK, and constructed a structural model of junior middle school mathematics teachers' TPACK that conformed to Chinese mathematics teachers' idiosyncrasies. Although a large number of TPACK studies have been conducted by current researchers, these studies are still insufficient for the study of TPACK in specific teaching contexts, and the disciplining of TPACK is an unstoppable development trend of current research. (Wang, 2020)

From the literature study, it is not difficult to find the shortcomings of the existing research on TPACK: First, most of the existing research on TPACK subjects focuses on Mathematics, Geography, English, Biology, Science and other disciplines, while the research on TPACK of language as a basic subject is obviously weak. Second, most of the existing research on TPACK focuses on universities and junior

and senior high schools, while research on elementary school teaching is slightly insufficient. Third, most of the TPACK-related research on teacher education student focuses on the current status of TPACK ability and the development of improvement strategy for teacher education students during the entire university period, and there is a lack of research targeting a specific stage. The author believes that TPACK is a kind of competence that grows in teaching practice, and the education internship stage is the period when teacher education students carry out teaching practice with the highest density and the best enhancement effect, therefore, choosing the enhancement of TPACK competence in the education internship stage as a research question has a high research value.

Teacher internship student

In order to make the literature study better help the author to carry out the study, this study only reviews the research results of the two parts of the high-quality related literature on educational internships and teacher internship student.

1. Educational internship

Educational internship is a crucial link in the talent training process of normal universities. It is the most direct and effective teaching practice activity that students in various normal universities participate in during the training of teacher education students. It is also the most systematic and standardized teaching practice activity that students participate in under the guidance of teachers inside and outside the school. It is very important for teacher education students to practice in the classroom. The transition from learner to leader and their respective professional growth play a very important role (Yuan, 2014). Universities are constantly exploring and reforming educational internship models to maximize the effectiveness of educational internships (Chen, Lin & Chen, 2016).

There are five modes of educational internship adopted by China's higher teacher training colleges and universities, including single-subject centralized fixed-point educational internship, mixed formation fixed-point educational internship, directed top-trial educational internship, autonomous educational internship and fully commissioned educational internship (Zheng, 2007).

At present, the existing research on educational internship is mainly divided into two categories (Zhang, 2019), one is to introduce the profile and mode of

educational internship in foreign countries, and to make up for the shortcomings of China's educational internship by drawing on the advantages of foreign educational internship. Some scholars have sorted out the educational internship models of the United States, Britain, France and Germany and conducted comparative studies with China, focusing on the analysis of internship duration, internship composition, organization and internship management in each country (Chen, 2004); some scholars have focused on a specific country and explained its educational internship model, internship characteristics and implementation (Wang & Zhu, 2007). In general, this type of research focuses on introducing the organization of internships, and lacks research on teacher pre-service education models and their guiding theories. The second is the exploration of educational internship in China. Some scholars have sorted out different types of educational internship models according to the choice of educational internship locations and organization (Zheng, 2007); some scholars have put forward suggestions for improvement by studying the relationship between university teachers, secondary school supervisors and teacher education students in educational internships (Wang & Lu, 2010). Considering the different content focuses of educational internships in different disciplines, researchers have also studied educational internships in different disciplinary specialties to explore internships adapted to their own disciplines (Wang, 2008). In addition, some researchers have proposed corresponding countermeasures from the problems that teacher internship students themselves have in their educational internships, such as students' lack of motivation for internships, weak foundation of professional knowledge, low level of professional skills, and backward concepts of internships (Meng & Wei, 2007; Zhang, 2015), some also analyzed the problems existing in educational internships from the school management level, such as unreasonable internship plans and time conflicts, lack of dual-skilled education teachers, lack of active cooperation in internship bases, and superficial Supervision and evaluation, etc., these problems have had a negative impact on teacher education students and teacher training (Li, 2019).

2. Teacher internship student

The researcher has found that research on the development of professionalism in teacher internship student is an important part of teacher internship student research findings and that several studies have suggested the enhancement of teacher internship students' professional development by

conducting teaching reflection.

Chen and Li (2016) selected 150 teacher internship students who participated in centralized internships and collected data by means of a semi-structured questionnaire that recorded the key events of educational internships on a daily basis, supplemented by observations, interviews, and situational recordings in natural situations during the internship process, and found that teacher internship students would go through the period of preparation for their roles during the internship, role adaptation, role formalization, role ambivalence, and role regression, and exhibit different response characteristics at different developmental stages. Izadinia (2016) used semi-structured interviews, reflective logs and observation notes to collect data to explore the changes in teacher identity of 8 junior high school teacher education students during their four-week closed internship and the factors that affected these changes. Finally, they used themes Analytical methods were used to interpret the data, and it was found that teacher education students gained a high level of self-confidence and rich feelings after the internship, and that a positive mentoring relationship helped to promote their identity as teachers. Wu (2009) conducted research on teaching reflection from the perspective of professional growth of teacher education students. He proposed that reflection should be conducted from four aspects: individual teachers, students, teaching and teaching environment. Regarding how to reflect on teaching well, Pan and Jiang (2005) mentioned in his research that commonly used teaching reflection methods include: applying microgrids to teaching, actively recording specific classroom situations, observing and analyzing the courses of outstanding teachers, and actively communicating with teachers. Lead colleagues to communicate with parents, study classroom actions, study individual outstanding teaching cases and learn teaching diagnosis, etc. Wang (2006) also believes that teaching reflection is an effective means for teachers to improve their self-awareness and promote the development of teachers' abilities. He emphasizes that teachers' self-reflection will help improve teachers' practical knowledge.

Through a review of relevant literature, it was found that domestic and foreign scholars' research on teacher internship students not only focuses on the improvement of the educational internship process, but also on the professional growth of teacher internship students. Many studies emphasize the importance of

teaching reflection in the professional growth of teacher internship students. It provides a strong research foundation for the development of this study. However, it should be pointed out that in the research on educational internships and teacher education students, there are only a handful of studies on how to improve the TPACK ability of teacher education students during the educational internship process. This is a pity for teacher education in the digital age. Therefore, this study takes TPACK teaching practice as the research perspective and proposes improvement strategy for the training of teacher internship students' information-based teaching ability, which is a very meaningful task.

Sampling Method

Sampling is an important technique used in modern social science research which can easily cover a large number of studies. Probability and non-probability sampling methods are used by researchers to learn about a population (Maree & Pietersen, 2016) and both are used in research to get reliable and trustworthy results (Hamid & Aslam, 2023).

We can learn from Baltes and Ralph (2022) the improvement of sampling methods in software engineering research to select sampling methods and complete sampling with high quality. Their research believes that different sampling methods are suitable for different situations which have different purposes. It is recommended that researchers choose the most appropriate sampling method based on the research purpose, method, context, and observation unit. The study points out that researchers can judge the appropriateness of sampling methods based on whether there is an available sampling frame, whether statistical inference is needed, whether diversity is needed, and they can also use tools such as charts, formulas, statistics, etc. to clearly describe and evaluate them. In the sampling process, biases that may affect sampling representativeness should also be identified and reduced through methods such as selection bias, coverage bias, and non-response bias.

The approach to study sample selection depends on the nature, purpose and research questions of the study, as well as available resources and time. The sampling method used in this study is purposive sampling. Purposive sampling is widely used in qualitative research and has been proven to be an effective, reliable, and time-saving sampling method.

In order to answer research questions about the use and reporting practices of convenience sampling methods in African psychology journals, a purposive sampling method was used to select a literature sample. From 361 empirical studies, 139 convenience studies were finally identified (Scholtz, 2021). Articles on sampling methods and classify and analyze them. In the study, the screening and exclusion criteria of the purposive sampling method formulated by Scholtz have three points: 1. Only select African psychology journals listed on the Web of Science Master Journal list. 2. Only select articles published from 2018 to mid-2020. 3. Exclude opinions, comments, discussions and theoretical articles, and only include empirical research.

A qualitative study on the issues and challenges faced by special education from the perspective of teachers. The purposive sampling method was used in the study to select 15 special education teachers as the research subjects. These teachers all have years of teaching experience and expertise and are able to answer research questions. In the study, the screening criteria using purposive sampling method was to select only special education teachers instead of general teachers. The exclusion criterion was to select only special education teachers with many years of teaching experience, rather than teachers who were new to the profession. The effect of using purposive sampling was to collect rich and in-depth data that reflected the challenges and solutions teachers face when educating children with learning disabilities. (Allam & Martin, 2021)

Purposive sampling method refers to selecting cases with rich information based on the purpose of the research, thereby effectively utilizing limited resources (Patton, 2014). The nature of this study is a mixed study, and the purpose of the research is to develop effective strategy for teacher internship students in the Chinese direction of primary education in universities, so as to improve the TPACK ability of teacher internship students, and ultimately achieve the transformation from teacher education students to qualified teachers. In this study, the author believes that purposive sampling can provide valuable research data for this study to the greatest extent. Relevant samples are selected as follows:

1. Sampling criteria for research subject involved in this study: (1) A normal university in Guangxi. (2) Teacher education students who will be engaged in primary school teaching in the future. (3) Teacher education students who are about to enter the educational internship stage.

2. There are three sampling criteria for the assessment experts involved in this study, such as assessment of research tools, assessment of strategy, and assessment of TPACK improvement effects: (1) More than 15 years of relevant professional work experience; (2) A master's degree or above, or a deputy senior or above professional title; (3) A senior Chinese teacher who has experience in teaching Chinese in primary and secondary schools and is engaged in teaching related courses in universities. As well as leaders engaged in teaching management of primary education majors in universities.

3. Sampling criteria for research literature involved in this study: (1) Relevant high-quality journal literature that can be searched in full text on CNKI and Googlescholar. (2) The number of citations is more than 5 times, and there is no limit on the number of citations for literature that are highly relevant to this research. (3) Master's and PhD related dissertations. (4) Mainly literature in the past five years.

Research Instrument

In order to evaluate the effectiveness of the TPACK improvement strategy in this study, it is necessary to conduct a timely survey of the TPACK ability of the research subjects at the beginning and after the educational internship. In view of the fact that most of the current TPACK ability assessments are conducted using self-report scales, which are highly subjective. Therefore, the researcher ordered two test papers according to certain standards and principles, one for the beginning of the internship and one for the end of the internship. Finally, the difficulty, question types, and covered knowledge points of the two test papers are the same, and the questions cannot be repeated. In this way, the interns' TPACK ability can be tested objectively, and the effectiveness of the strategy can be tested by comparing the level of TPACK ability before and after the strategy is implemented.

The research tool used in this study is test paper. Clarifying the proposition principles of the test paper is the first step in preparing a qualified test paper. The following is some literature on the principles of test paper preparation:

Villarroel et al. (2020) proposed principles for improving written exams and tests, including realism, cognitive challenge, and evaluative judgment to increase exam authenticity and deep learning. Gong (2003) proposed four principles for the propositions of Chinese test papers in the college entrance examination, including

article length and subject matter, test content and difficulty, fairness and rationality, and reading speed and ability. Chen (2011) elaborated on the proposition principles of the Chinese test papers of the College Entrance Examination, including compliance with the requirements of educational measurement, policy requirements of the College Entrance Examination, and compliance with the requirements of the Chinese subject. Su (2001) proposed the principles of propositions for high school English tests, including realistic questions, emphasis on language use, accuracy of multiple-choice questions, and consistency in content and teaching. He and Gao (2008) introduced the principles of scientificity, comprehensiveness and typicality, clarity, hierarchy and distinction, and student-oriented principles to guide the design of test papers. Nie (2020) proposed the principles for the propositions of the Chinese college entrance examination paper, including regionality, sense of the times, and life-oriented. Zhang (2017) discussed the principles of propositions in history examination papers, including taking curriculum standards as the basis, taking students' learning and development as the starting point, drawing on proposition experience in advanced areas, taking scientific norms as the principle, and enriching proposition forms. Yao (2003) emphasized the motivational principle and the guiding principle to promote students to display their Chinese talents and provide diagnostic and guiding information.

In view of the above literature research, it is concluded that when conducting TPACK ability tests for teacher internship students, the proposition principles of consistency of educational goals and practical application should be considered to ensure the validity and quality of the test.

Consistency with educational goals: Test questions should be consistent with educational goals and relevant requirements of the TPACK framework. The test should reflect the technological, pedagogical, and subject knowledge that teachers need to possess, that is, the test should be divided into seven dimensions: TK, PK, CK, TPK, PCK, TCK, and TPCK. At the same time, the test should also select questions of moderate difficulty based on the level of the teacher internship students at the school.

Practical applicability: The test questions should focus on testing candidate teachers' ability to apply TPACK in actual educational scenarios. This may include tasks in situation analysis, problem solving, instructional design, etc.

Considering that the research tool of this study is test paper, which is more like a questionnaire in nature, this study will analyze recent Chinese high-quality journal papers and master's theses that utilize the TPACK testing method as a survey method. The research focuses on teacher internship students and aims to compile effective test papers through literature analysis. it was found that most of the research tools used by Chinese scholars in the study of TPACK ability measurement of teacher education students are based on the questionnaires of Denise A. Schmidt, Archambault, Crippen, Chai and others, combined with localization and subject characteristics, adapted to form a questionnaire (Huang, 2015; Zhang & Wang, 2016; Wang & Wu, 2018; Cui, 2018; Gao et al., 2022; Qin, 2022; Hou, 2022; Yu et al., 2022; Duan, Yan & Yu, 2016).

Table 2.2 Dimensions and question statistics of teacher education students' TPACK measurement carried out using questionnaire surveys in recent years

Author	Establishment basis	Dimensions	No. of question	TK	PK	CK	TPK	TCK	PCK	TPCK
Huang	Archambault questionnaire, Crippen questionnaire	7	21	US	US	US	US	US	US	US
Zhang & Wang	Schmidt questionnaire	7	27	US	US	US	US	US	US	US
Wang & Wu	Schmidt questionnaire, Archambault questionnaire	7	26	US	US	US	US	US	US	US
Cui	Schmidt questionnaire, Zhan Yi questionnaire, Zhang Zhe questionnaire	7	33	7	7	3	5	3	3	5

Table 2.2 (Continued)

Author	Establishment basis	Dimensions	No. of question	TK	PK	CK	TPK	TCK	PCK	TPCK
Gao et al	Chai questionnaire	7	42	9	6	4	5	4	8	6
Qin	Multiple questionnaire	7	31	US	US	US	US	US	US	US
Hou	Schmidt questionnaire, Archambault questionnaire, Chai questionnaire	7	36	7	6	3	5	4	5	6
Yu et al	Schmidt questionnaire, Archambault questionnaire, Graham questionnaire	7	33	6	7	3	5	3	3	6
Duan et al	Multiple questionnaire	7	42	9	6	4	6	4	8	5

Note: US refers to unspecified.

From a large amount of literature research, researchers have found the following: Most of the questionnaires used to conduct TPACK ability testing using the questionnaire survey method are based on the Schmidt questionnaire and the Archambault questionnaire, etc., and are compiled based on the subject characteristics of the respective studies or other actual situations. The questionnaires are divided into seven dimensions: TK, PK, CK, TPK, TCK, PCK, and TPCK. Each dimension has about 3 to 9 questions, and the total number of questions is about 20 to 40 questions.

Before the test, the test paper was handed over to five relevant experts. The experts reviewed the test questions and the content they learned during college, the difficulty of the test questions, the coverage requirements of the test

questions, the question structure and score distribution requirements, the test question volume requirements, and the repetition rate of the two test papers. The test paper will be reviewed from 8 aspects, including question volume, difficulty requirements, whether the test paper scoring standards are scientific and feasible, and whether there are any errors in the test paper. The test paper will be adjusted or used directly based on the expert review results.

Assessment Method

1. Expert assessment method

Expert assessment focuses on assessing the effectiveness of a project, policy, or program through specialized knowledge and experience. Assessments are typically performed by experts or professionals in the field, who use their own insights and judgment to evaluate the project. Expert assessment is widely used in aspects such as test paper quality, teaching quality, course quality, and educational research.

In Zhuang's study, an expert advisory group composed of 23 junior high school Chemistry teachers, teaching researchers, and Ph.D.'s in Chemical education conducted expert consultation and analytic hierarchy process to determine the Chemistry test questions for the high school entrance examination. The weight of indicators at each level of difficulty assessment. When testing the content validity of the assessment indicators, the researcher identified 7 experts, one of whom was a test question research expert with 23 years of teaching experience and a senior professional title; two were city-level teaching researchers, both for the regional high school entrance examination The organizers and participants of the proposition; there are also 4 front-line junior high school chemistry teachers with an average teaching experience of 17 years, all of whom are senior teachers. The composition of the expert group can ensure that information is collected from both the high school entrance examination question setters and front-line teachers and can comprehensively and truly reflect the content validity of the indicators (Zhuang, 2021).

Hu et al (2006) studied how expert assessment was carried out in the classroom teaching quality assessment of Wuhan institute of Physical education. The assessment experts were organized by the Teaching and Training Supervision Office

of Wuhan Institute of Physical Education to evaluate the quality of classroom teaching in technical and theoretical courses. Expert assessment adopts observation method, interview method, literature method and comparative analysis method, and uses specially designed assessment questionnaire. Assessment experts randomly select technical and theoretical course teachers, and each teacher's classroom teaching is evaluated on-site by more than three supervision experts. Experts conduct statistical analysis and comparison based on the score rate of each indicator (first-level indicator and second-level indicator) to reflect the teacher's teaching level and effect. Research shows that expert assessment results can help improve the quality of classroom teaching in physical education colleges.

Xuan (2017) used expert assessment methods to initially construct an assessment index system for high-quality online open courses in higher vocational colleges in Guangdong Province. In this study, the principles, and methods for selecting the expert group are as follows: 1. The selected experts must have considerable knowledge and understanding of high-quality online open courses, so as to ensure that the data and suggestions provided by the experts are more credible and professional. These include front-line teaching teachers, school leaders in charge of teaching work, and teaching quality supervision. 2. The research is to develop an indicator system for high-quality online open courses suitable for higher vocational colleges in Guangdong Province and takes career development and employment guidance courses as an example. Therefore, the expert group mainly chose the leadership and management of higher vocational colleges in Guangdong. personnel, and teachers engaged in work related to career development and employment guidance. 3. According to relevant theories of educational assessment, the number of experts selected by the expert questionnaire method is 15-20. Considering that experts are busy at work and may not have time to complete the questionnaire, this study selected 23 experts to distribute the questionnaire, including frontline There are 10 teaching teachers, 8 school leaders in charge of teaching work, and 5 teaching quality supervisors.

Ding and Miao (2021) using expert assessment methods when studying the international influence of Chinese educational research. The experts participating in the assessment are divided into three categories: foreign education experts (8 people), Chinese education experts at home and abroad (10 people), and mainland

China education experts (11 people). They are all well-known and influential scholars who have made achievements in educational research. The experts used questionnaires to examine the international influence of China's educational research comprehensively and systematically from multiple dimensions.

According to Aithal (2020), in test paper quality inspection, expert assessment is a method to check whether the test paper content can effectively measure the expected theoretical constructs and can be carried out after the test paper is designed. Its role is to ensure that the items in the test paper can represent the entire field of research questions and that there are no missing or redundant items. It can also provide suggestions and improvements on the language, format, clarity, etc. of the questionnaire items. The qualifications of an expert are that they have extensive experience and knowledge in the subject or field covered by the test paper and can evaluate the content of the test paper objectively, impartially and professionally.

At the same time, Kallio et al (2016) pointed out that in the quality inspection of interview outlines, expert assessment is to invite experts in relevant fields to criticize and make suggestions on the preliminary interview outline to check whether the content of the interview outline is suitable for the research purpose and questions. Is it comprehensive and accurate? The method of expert assessment can be to send interview outlines to experts by email, phone or face-to-face and solicit their opinions and feedback. The results of the expert assessment can be used to revise and improve the interview outline, such as adjusting the order, wording and scope of questions.

In this study, expert assessment mainly evaluates the quality of test papers and interview outlines, the admission criteria for the five experts were: more than 15 years of relevant professional work experience; a master's degree or above, or a deputy senior or above professional title; a senior Chinese teacher who has experience in teaching Chinese in primary and secondary schools and is engaged in teaching related courses in colleges and universities. As well as leaders engaged in teaching management of primary education majors in universities.

Before the test, the test paper was handed over to five relevant experts. The experts reviewed the test questions and the content they learned during college, the difficulty of the test questions, the coverage requirements of the test

questions, the question structure and score distribution requirements, the test question volume requirements, and the repetition rate of the two test papers. The test paper will be reviewed from 8 aspects, including question volume, difficulty requirements, whether the test paper scoring standards are scientific and feasible, and whether there are any errors in the test paper. The test paper will be adjusted or used directly based on the expert review results.

Before implementing the strategy, the formulated strategy was handed over to five relevant experts. Experts will evaluate the basis for strategy formulation, the principles of strategy development, the specific content of the strategy, and the effectiveness assessment of the strategy from four aspects: practicality, feasibility, appropriateness, and accuracy, to ensures the quality of the strategy.

2. CIPP assessment method

CIPP is an educational assessment model proposed by American educationist Stafforbin. It includes four parts: background assessment (Context), input assessment (Input), process assessment (Process) and effectiveness assessment (Product). The principle of CIPP is to aim at improvement rather than proof, emphasize the assessment process and feedback, and pay attention to all links and levels of educational practice (Xiao, 2003). The CIPP assessment model has been widely used in different fields and projects. It has the advantages of comprehensive assessment, strong practicability, wide applicability, and helpful for feedback and improvement. At the same time, the CIPP model also has limitations such as the complexity of assessment operations, the cost of data collection and analysis, and the possibility of neglecting certain specific areas or issues. Therefore, when using the CIPP model, it is necessary to weigh its advantages and limitations, and adjust and innovate according to specific situations and needs.

The CIPP assessment model is widely used in the field of education: Wei (2023) put forward optimization suggestions for the non-academic education and training quality assessment index system of Lanzhou University based on the CIPP model. Researcher believe that the CIPP evaluation model can conduct a comprehensive analysis and evaluation of the quality of non-academic education and training from multiple dimensions and levels, can flexibly select appropriate methods and tools according to the actual situation, and provide feasible improvement measures and suggestions, and can be used collecting effective data

and information through a combination of quantitative and qualitative methods, conducting rigorous analysis and demonstration, can fully mobilize the participation awareness and enthusiasm of all stakeholders, and provide timely feedback on evaluation results and effects. It is comprehensive, systematic, and reliable. It has the advantages of operability, practicality, scientific, objectivity, participation, and feedback. In addition, Zhong and Wei (2020) drew on the CIPP assessment model to construct a core index system including background, input, process, and outcome assessment indicators. Wang (2015) used the CIPP assessment model and established a vocational education quality assessment index system through the Delphi expert consultation method, which helps to improve the quality of vocational education. Tuna and Başdal (2021) used the CIPP model to evaluate the quality and value of tourism undergraduate education programs in Turkey, providing a basis for the improvement of educational programs. Irene (2023) used the four stages of the CIPP model to analyze the context, input, process, and product of the course to improve the matching of the course and the exam. Hasan et al (2015) analyzed different aspects of mechatronics courses using the four stages of the CIPP evaluation model, highlighting the comprehensiveness and effectiveness of the model in evaluating educational programs Practicality. Karatas and Fer (2011) used the CIPP assessment model for English course evaluation research and emphasized the effectiveness and practicality of the CIPP model. Zhi et al (2012) using six indicators and four questionnaire topics of the CIPP model, the training project was evaluated and proved The application of CIPP model can improve training efficiency and quality.

Based on the above literature, the CIPP assessment model is used for the design and assessment of TPACK ability improvement strategy in the educational internship stage. In this study, the steps for CIPP assessment are as follows:

Step 1. Background assessment: Society and the times' requirements for teacher internship students' TPACK ability; Understand the current status of the intern's TPACK ability, including technical, teaching and subject knowledge, which will be conducted through tests and literature analysis; Determine the TPACK ability improvement goals of teacher internship students.

Step 2. Investment assessment: Develop corresponding improvement strategy based on the needs and current situation of teacher internship students.

Step 3. Process assessment: During the internship process, monitor the

intern's performance in implementing strategy, including classroom performance, homework completion, etc.

Step 4. Result assessment: After the internship, a comprehensive assessment of the internship will be conducted, including knowledge and skill level, teaching quality, student feedback, etc., through tests, instructor assessment, primary school student assessment, etc.

It should be noted that CIPP is an assessment for the purpose of improvement. Therefore, attention should be paid to the support and guidance of interns throughout the process, and they should be encouraged to actively participate and continuously improve their TPACK abilities.

Strategy Development

Strategy development refers to the process of formulating reasonable action plans and methods based on certain goals, conditions, and environment. In order to reflect the completeness of the strategy development process, the researcher selected 4 literatures on the development of strategy for improving teachers' information technology ability that are somewhat relevant to this study. From the basis of strategy development, principles of strategy development, general steps of strategy development, The four aspects of strategy effectiveness test include a comprehensive analysis of strategy development, so that effective strategy for improving teacher education students' TPACK abilities can be developed based on summarizing the experience of previous strategy development.

1. Basis for strategy development

Fu (2013), when developing strategy for the information-based teaching ability of secondary vocational teachers, provided basis for strategy development based on both positive and negative aspects: on the one hand, it was based on the current situation survey, case studies and expert interviews of teachers' information-based teaching abilities in Guangxi secondary vocational schools. As a result, the existing problems and influencing factors of information-based teaching for secondary vocational teachers were analyzed. On the other hand, it summarizes the excellent practices and experiences of information-based teaching for secondary vocational teachers based on the results of Guangxi secondary vocational teachers' modern educational technology and curriculum integration training, information-based

teaching competitions, and information-based teaching reform projects. When Wang (2022) studied the issue of improving the comprehensive ability of junior high school Chinese teachers under the background of "double reduction", he investigated and analyzed the level, existing problems and causes of the comprehensive ability of junior high school Chinese teachers in area X and proposed corresponding improvement strategy on this basis. Yang (2023) in “Research on strategy for improving the informatization teaching ability of junior high school History teachers”, based on Koch's four-level model (composed of 4 levels: reaction layer, learning layer, behavior layer and result layer), combined with the information of junior high school history teachers Problems and reasons for teaching ability exist, and corresponding improvement strategy are proposed from these four levels. Li (2022) summarized the core ability that teachers should have in the era of educational informatization 2.0-TPACK ability by sorting out policy documents and related research. The article also summarized the ways and methods for the deep integration of information technology and subject teaching based on TPACK. It provides a basis for developing the TPACK ability of normal university students and reforming the curriculum system.

2. Principles of strategy development

Fu (2013) pointed out in his research that the development of strategy to improve the information-based teaching ability of secondary vocational teachers should adapt to the actual needs and development stages of secondary vocational teachers and vary from person to person and from time to time. At the same time, attention should be paid to the comprehensive and in-depth integration of information technology and education, with students as the center, teaching as the main line, and results as the guide. It is also necessary to give full play to the roles and resources of the government, schools, society, and other aspects to form a joint force to jointly promote the continuous improvement of the information-based teaching ability of secondary vocational teachers.

Wang (2022) takes students as the center, teachers as the main body, schools as the support, and society as the reference as the principles of strategy development.

Yang (2023) proposed a strategy to improve the information-based teaching ability of junior middle school history teachers. The principle of formulating the

strategy is to take teachers as the main body, students as the center, and teaching as the core, that is, fully respecting the autonomy and individual needs of teachers, Pay attention to the professional development of teachers and the improvement of information literacy, and also pay attention to the cultivation of students' information learning abilities and core literacy of history courses, as well as the in-depth integration of information technology and history teaching content and methods.

Li (2022) took N University as an example to investigate the current curriculum and teaching status of the school, and based on the curriculum reform basis, starting from the teaching objectives, teaching content, teaching implementation and teaching assessment of the curriculum, the existing "Educational technology application" course was reformed and innovatively designed, and relevant teaching resources and scaffolds were developed, ultimately forming a set of "Educational technology application" course system based on TPACK ability.

3. General steps in strategy development

Fu (2013) believes that complete strategy development generally goes through five steps: determining goals, analyzing the current situation, formulating measures, implementing plans, and evaluating effects. In her research, the steps to improve the information-based teaching ability of secondary vocational teachers are: 1. Determine the goal: clarify which aspects of the information-based teaching ability of secondary vocational teachers should be improved, such as information-based teaching design ability and digital resource application ability, information-based teaching implementation ability and information-based teaching assessment ability, etc. 2. Analyze the current situation: Through questionnaires, case studies, expert interviews, and other methods, understand the current situation, existing problems and influencing factors of the information-based teaching ability of Guangxi secondary vocational teachers, and identify areas that need improvement and optimization. 3. Formulate measures: Based on the goals and current situation, propose specific and feasible improvement strategy, such as increasing investment, establishing a leadership group and expert team, carrying out various projects and activities, strengthening training and assessment, establishing systems, etc. 4. Implementation plan: Based on the measures, formulate a detailed implementation plan, including time arrangement, task division, resource allocation, supervision

mechanism, etc. 5. Evaluate the effect: Based on the goals, use various methods and methods, such as testing, observation, interviews, feedback, etc., to evaluate the implementation effect of the improvement strategy, analyze the effectiveness and deficiencies, and make timely adjustments and improvements.

In Wang (2022) study, the steps for developing ability improvement strategy are: The first step is to clarify the goals and content of improving the comprehensive ability of Chinese teachers, namely teaching ability, class management ability, home-school communication ability, after-school service ability and Learning ability. The second step is to analyze the conditions and obstacles to improving the comprehensive ability of Chinese teachers, namely regional factors, parent expectation factors, teacher factors, etc. The third step is to formulate specific measures and methods to improve the comprehensive ability of Chinese teachers, that is, to give corresponding suggestions and strategy from the school management level and the teacher's own level. The fourth step is to implement plans and programs to improve the comprehensive ability of Chinese teachers, that is, to operate and execute according to the established measures and methods, and to provide supervision and feedback at the same time.

In Yang (2023) study, the steps to formulate strategy are: analyze the current situation - determine goals - select methods. Specifically, The first step is to understand the current status and existing problems of junior middle school history teachers' information-based teaching ability through questionnaires, interviews, etc. The second step is to determine improvement goals and indicators based on Koch’s four-level model. The third step is to select appropriate training methods and resources.

In the study of Li (2022), the steps to formulate strategy are: first, clarify the connotation and composition framework of TPACK in the information 2.0 era, and elaborate on the connotation of each element in the framework. Second, analyze the advantages and disadvantages of the existing “Educational Technology Application” course, and propose the basis for curriculum reform based on the needs of TPACK ability training in the information 2.0 era. Third, design the teaching objectives, content, implementation, and assessment of the “Educational Technology Application” course, and develop corresponding teaching resources and scaffolds to form a curriculum system based on TPACK abilities.

4. Methods to test the effectiveness of strategy

Testing the effectiveness of the developed strategy mainly depends on the goals and standards of the strategy, as well as the implementation results and feedback of the strategy.

In Fu (2013) study, the effectiveness of the strategy was tested in three aspects: First, the information teaching ability level of secondary vocational teachers before and after the implementation of the improvement strategy was compared and analyzed to see whether there was a significant improvement. The second is to track and examine the information teaching practice of secondary vocational teachers after implementing the improvement strategy to see if there are any innovations and breakthroughs. The third is to collect feedback from secondary vocational teachers on their satisfaction and recognition of the improvement strategy to see if there are any positive comments and suggestions.

In Wang (2022) study, the effectiveness of the strategy was tested in three aspects: First, by comparing the assessment results of the comprehensive ability of Chinese teachers before and after implementation to see if there is any obvious improvement or improvement. The second is to collect feedback on the comprehensive ability of Chinese teachers from students, parents, colleagues, leaders and other relevant personnel to see if there is any positive assessment or recognition. The third is to observe the performance of Chinese teachers in classroom teaching, class management, home-school communication, after-school services, etc. to see if there is any innovation or optimization.

In Yang (2023) study, the method to test the effectiveness of the strategy is to use Koch's four-level model for assessment, that is, to collect data and evidence from four aspects: reaction layer, learning layer, behavior layer and result layer, and analyze teachers' satisfaction with training activities degree, the degree of mastery of knowledge and skills, the degree of change in teaching behavior and the degree of improvement of teaching effect, to judge whether the strategy has achieved the expected goals.

In Li (2022) study, the method to test the effectiveness of the strategy was to use a combination of quantitative and qualitative research methods, including questionnaires, interviews, observations, document analysis, etc., to collect the TPACK ability levels of teacher education students before and after the course,

Attitudes, satisfaction and other data. Conduct in-depth reflection and discussion based on the data analysis results, summarize the advantages and disadvantages of course design in cultivating the TPACK ability of teacher education students, and put forward suggestions for improvement.

To sum up, this study's development of TPACK ability improvement strategy for teacher internship students' teaching practice should be based on an in-depth analysis of the current situation, and strategy should also be proposed based on specific models or theories. The common principles of strategy development should be to meet the actual needs and development stages of educators, while focusing on the deep integration of education and technology, being student-centered, and emphasizing multi-party cooperation to promote the improvement of TPACK ability. In this study, the steps for strategy development are as follows: 1. Determine the goals and clarify which ability or dimensions to improve. 2. Analyze the current situation and understand the existing conditions and problems. 3. Develop measures and propose feasible strategies and methods. 4. Implement plans and execution strategy. 5.When verifying the effectiveness of ability improvement strategy, should adopt a before-and-after comparison method, use multiple data sources, including feedback, pay attention to teaching innovation and optimization, conduct in-depth analysis and make suggestions for improvement.

The relevant contents for formulating the strategy of this research are as follows:

Basis for strategy formulation: According to the results of literature research, TK, PK, and CK are the most basic abilities that form their TPACK. Teaching reflection is the most effective way for teacher internship students to improve their TPACK. According to the TPACK test results of teacher internship students, the abilities of teacher internship students in the overall and seven dimensions of TPACK are below Passable. Therefore, during the 8 weeks educational internship stage, the researcher developed a training plan, which included courses to improve the three basic abilities of TK, PK, and CK, and improved the integrated skills of TPK, TCK, PCK, and TPACK through teaching reflection.

2. The intended goal of the strategy: Through the implementation of the training plan, teacher internship students’ TPACK ability will be improved from "Poor" level to "Average" level.

3. Strategy development steps and specific content: The developed training plan has a total of 48 class hours, including 25 class hours of theory and 23 class hours of practice. The researchers formulated the corresponding teaching content based on questions in various internationally popular TPACK ability measurement questionnaires, as well as related questionnaires on TPACK ability measurement in Chinese subjects.

4. Implementation mode of the strategy: First, taking into account that the teacher internship students have a lot of internship work during the day and that each internship student is assigned different tasks by different supervisors in the internship schools. Therefore, the teaching time was scheduled in the evening, with 2 class periods of 40 minutes each. Starting from the first day of the internship, classes are held in the evening every day except Saturdays and Sundays, and it takes 18 days to complete the teaching of the TK, PK and CK courses. According to the internship arrangement, generally from the fourth week onwards, the intern school instructor will arrange for the teacher internship students to teach independently after the interns are familiar with the school environment, familiar with the primary school students, and have a certain number of observation teachings. Therefore, starting from the 4th week, 6 teaching observations and teaching reflections were arranged in the training programme. Students were provided with six quality teaching videos on the five major modules of Chinese in primary school (Pinyin, recognizing Chinese characters and writing Chinese characters, reading, writing, comprehensive learning, and oral communication). After watching the videos, teacher internship students were divided into groups of 5-8 students. Groups discussed the videos and communicated and exchanged ideas. Second, considering that TPACK is an ability developed in teaching practice, many teaching practice courses have been set up in the training, and many classroom teaching exercises have been added to the theoretical courses to provide more training opportunities for teacher internship students. Third, the online teaching model itself is also a reflection of TPACK's ability. In the future, teachers also need to have the ability to teach online and be familiar with new teaching forms such as micro-classes and flipped classrooms.

5. Assessment of TPACK ability: The assessment of TPACK ability is a diversified assessment, including the following five aspects: First, the performance of teacher internship students in training courses, and the course training teachers are

responsible for giving training results. The second is the evaluation of the teacher internship students by the intern school instructors, which is expressed by the intern instructors in the form of internship comments and internship scores. The third is the evaluation of teacher internship students by primary school students in the internship school, collecting oral evaluations from primary school students. The fourth is the score of the TPACK test of the student teachers after the internship. The fifth is the self-evaluation of teacher internship students, which is reflected from the interns' internship summary. The sixth is the peer assessment of teacher internship students, which is expressed in the form of internship comments and internship scores by the internship group to which the teacher internship students belong.

Related Research

The research keywords involved in this study include TPACK ability improvement strategy for teacher education students in the educational internship stage, teaching practice research on combining TPACK with primary school Chinese courses, etc. After a large amount of literature research, the researcher will use the literature related to the above keywords organized.

1. TPACK ability improvement strategy for teacher education students in the educational internship stage

Gao et al (2020) studied the role of educational internships on the technology-integrated subject teaching knowledge (TPACK) level of geography science teacher education students. Through a questionnaire survey of 162 Geography science teacher education students who had just participated in educational internships in several universities in different regions of the country, it was found that educational internships can significantly improve the TPACK level of interns, with CK increasing the most and TK increasing the smallest; There is a significant positive correlation between the improvement of each dimension of TPACK; there is no significant difference in the improvement of TPACK between different genders and whether they are public-funded normal university students, while the willingness to teach has a significant impact on some dimensions. Based on the research results, the article proposes that we should attach great importance to educational internships and improve the weak links of interns in a targeted manner; the improvement of information technology can better serve teaching; teaching

willingness is an important way to improve TPACK and other research conclusions.

Based on the constructivist learning theory, peer assistance theory and information technology and curriculum integration theory, Ma (2021) explores the influencing factors of the development of TPACK for teacher education students during educational internship, in order to provide help for the cultivation of TPACK for teacher education students. The study first identifies these influencing factors through document analysis and interview results. Then, based on the theories of constructivism, peer assistance, information technology and curriculum integration, and previous empirical research, hypotheses of related relationships were established. Then, based on previous questionnaires, a research questionnaire was designed, and a survey and data analysis were conducted. The study used AMOS to construct a structural equation model to verify these hypothesized relationships, and finally obtained a revised structural equation model and influencing factor model. Finally, based on the influencing factors model, suggestions are put forward on how to train teacher education students to develop TPACK. This study identified five main influencing factors for teacher education students to develop TPACK during educational internships, including personal reflection, self-efficacy, human factors (such as internship instructors, internship peers, and students), educational training courses, and software, hardware, and leadership support. These external environmental factors will affect the development of TPACK, and they will also be affected by personal internal factors. The study made recommendations based on these influencing factors, including improving education and training courses, focusing on internship planning, encouraging peer assistance, and encouraging personal reflection to promote the positive development of TPACK.

Huang and Zhuang (2022) used 190 undergraduate teacher education students who had participated in educational internships in a local university in Guangdong Province as a research sample and designed an information-based teaching practice ability questionnaire for teacher internship students based on the TPACK framework and used SPSS26.0 software to analyze the data. describes the basic information of teacher internship students, the overall level of TPACK, difference analysis and regression analysis; it is found that the information teaching practice ability of teacher internship students is at a medium level and is affected by factors such as frequency of guidance and teaching knowledge. Finally, based on the

current status of teacher internship students' teaching practice ability and its influencing factors, the researchers proposed strategy to improve the teacher education curriculum system, apply blended learning models, and implement diversified guidance and practice mechanisms to improve the information teaching practice ability of teacher education students.

Li (2020) used a mixed research method to explore the impact of educational internship on English teacher education students' TPACK self-efficacy, including changes before and after the internship and influencing factors. The research methods include questionnaires, in-depth interviews and content analysis based on teaching files to comprehensively understand the TPACK self-efficacy of English teacher education students. The research subjects were 55 English teacher education students who were assigned to participate in a two-month educational internship in elementary schools, junior high schools or high schools. They filled out a questionnaire on TPACK self-efficacy before and after the internship and were interviewed after the internship. Their teaching documents were also collected as a source of data. The research results show that educational internship has a positive impact on English teacher education students' TPACK self-efficacy, especially in TPCK and CxK. Influencing factors include technical support from the internship school, demonstration by mentor teachers, feedback and encouragement from peers, and personal attitudes and emotional states. This study empirically proves that educational internship is an effective way to cultivate TPACK self-efficacy of English teacher education students. Research limitations: The article also pointed out some limitations of the research, such as small sample size, short data collection time, and simple data analysis methods. This article suggests that future research can expand the sample scope, extend the data collection period, adopt more complex data analysis methods, etc., to improve the reliability and validity of the research.

2. Teaching practice combining TPACK with primary school Chinese courses

China's research on TPACK in the Chinese subject began in 2014. Researchers used the instructional design seminar of Chinese teachers in the national information technology and curriculum integration competition as a sample to analyze the TPACK level of junior high school Chinese teachers. (Zhao & Tang, 2014)

Liu et al (2017) used a case analysis method, taking the first-grade Chinese “ai ei ui” as an example, and introduced how to design teaching according to the TPACK framework, select appropriate technological, pedagogical and content, create scenarios, stimulate interest, and cultivate ability. During teaching, Chinese teachers use PPT, animation, pictures, and other forms to present teaching content and build vivid and real teaching scenarios. In view of the characteristics of first-grade students such as difficulty in concentrating and weak learning motivation, we use situational teaching methods, task-driven methods, and other methods to stimulate their interest and participation. The article explains the teaching steps based on the TPACK framework as follows: 1. Analyze the subject content knowledge, technical knowledge, and pedagogical knowledge of primary school Chinese courses. 2. Design teaching activities based on the TPACK framework, create real situations, guide students to establish connections between old and new knowledge, let students master the sounds, shapes and four tones of compound vowels, and practice their spelling skills. 3. During the teaching process, use multimedia forms to display teaching content, intersperse story scenes of the tortoise and the hare, maintain students' learning motivation, stimulate students' thinking through guidance, questions, etc., and establish connections with real life. 4. Recall the main content of this teaching as a whole and propose knowledge points for the next class for students to think about. The article believes that teaching design based on the TPACK framework can improve the teaching quality and effectiveness of primary school Chinese teachers, make the teaching content presented more intuitive, stimulate students' interest and participation, and strengthen the practicality and humanities of the Chinese subject. The article also points out that TPACK is a new teaching integration that provides a new direction for teachers' teaching design. It not only emphasizes the dominant position of students, but also puts forward the important influence of teachers in coordinating the entire teaching activities. Teachers should actively learn and skillfully use TPACK knowledge concepts, to flexibly apply various teaching elements in teaching practice, highlight the important role of teachers in guiding students' learning process, and promote further reform of the education model.

Chen (2020) took first-grade Chinese literacy teaching as an example to study the design and application of literacy teaching models supported by information

technology, aiming to provide front-line teachers with a practical information technology-supported literacy teaching model and enrich classroom teaching forms, stimulate students' interest in literacy, improve teaching efficiency, and cultivate students' multi-channel literacy and independent literacy habits. This paper takes Chinese teachers and students in the first grade of primary school, as well as parents of students as the research objects, and adopts various research methods such as literature research method, questionnaire survey method, interview method and classroom observation method to collect and analyze data and build an information technology support system. The five rings and six modernizations literacy teaching model was adopted, and two teaching cases were designed for practical application. Through classroom observations and teacher interviews, it was found that this model can effectively stimulate students' learning motivation, increase classroom interaction, enrich classroom activities, improve the effect of formative assessment, and expand literacy pathways. The article believes that the five rings and six modernizations literacy teaching model supported by information technology is an extension and development of previous research, expands and enriches the models, strategy and methods of literacy teaching supported by information technology, and provides an operational practice model for front-line teachers. The article summarizes the strategy and methods for information technology to support classroom introduction, classroom interaction, classroom activities, formative assessment, and expansion and consolidation, which can provide direction and reference for teachers to apply information technology in literacy teaching. The design, analysis and summary of the case provide reference for the specific practice of front-line teachers and are conducive to promoting the deep integration and innovative application of information technology and primary school Chinese literacy teaching.

Based on the TPACK framework, Huang and Pan (2018) analyzed the design and application of primary school Chinese teaching from three aspects: subject content knowledge, technical knowledge, and pedagogical knowledge. The research targets students in the second semester of the first grade of primary school. Taking the lesson "Little gecko borrowing its tail" as an example, it uses a computer with text display, spotlight, hiding, audio playback, writing, magic ink, drag, page jump, and free annotation. The interactive electronic whiteboard with other functions follows the six steps of creating situations, implementing new words, student exploration,

group collaboration, expanding thinking, and writing guidance, and uses different teaching strategy and technical functions to achieve Chinese teaching goals. The research results show that the primary school Chinese teaching design based on TPACK highlights the leading role of teachers in the integration process of technology and teaching, stimulates students' subjectivity and creativity, and improves students' comprehensive quality and team awareness. Researchers believe that the TPACK concept guides a new direction in the integration of information technology and subject curriculum, provides an effective guidance method for primary school Chinese teachers to integrate technology in teaching, and is conducive to promoting further reforms in teaching models.

Mo et al (2019) took the second-year e-commerce major of a secondary vocational school as the research object, and took the secondary vocational Chinese course “Learning to write IOU” as an example to explore how to apply the TPACK framework to information-based teaching design. In the study, the researchers used tools including micro-classes, micro-videos, Lanmoyun classes, WeChat, WeChat barrage, QQ live broadcast, multimedia courseware, mobile phones and other tools to help teachers and students conduct effective information-based teaching and learning. The teaching link of this course is divided into six links: pre-class link, situation introduction, new lesson teaching, practical exercises, display and assessment, summary and reflection. In each link, teachers must analyze and integrate technology according to the TPACK framework. Knowledge, subject content knowledge and teaching method knowledge, create interesting learning situations, design meaningful learning tasks, and achieve effective interaction and feedback. The research results show that the information-based teaching design based on the TPACK framework can improve the efficiency, effectiveness and quality of Chinese teaching in secondary vocational schools, stimulate students' learning interest and participation, and cultivate students' language application ability and critical thinking ability. Researchers suggest that teachers should conduct information-based teaching design based on the TPACK framework. They need to strengthen their practice in various aspects of knowledge, clarify the relationship between technology, teaching methods, and subject content in the teaching process, and combine specific teaching scenarios and different types of teaching content, Select appropriate teaching models, teaching methods and strategy and appropriate information technology.

Kong (2021) based on the TPACK conceptual framework, explored the teaching behavior, media technology use, TPACK knowledge and their relationships in primary school Chinese reading classes, using a combination of literature analysis, video analysis and interviews to conduct a study of ten selected sections of excellent primary school Chinese reading Classroom videos were coded and analyzed in depth, and data on frequency, duration, and relationships of classroom teaching behaviors, media usage, and TPACK knowledge were obtained. Through the analysis of the data, suggestions were made to improve the level of TPACK knowledge and enhance technology integration ability; focus on Question-based inquiry-based teaching cultivates students' reading interests and abilities; strengthens communication and cooperation among teachers, promotes professional growth, and other development strategy for primary school Chinese reading classroom teachers. This study provides theoretical reference and practical guidance for novice Chinese teachers, and better promotes teachers' professional development.

Through the above literature review, researchers found that information-based teaching ability is an important ability that contemporary teachers must possess, and the TPACK framework provides a theoretical basis for teachers to better carry out information-based teaching. Although there are many articles on the research on TPACK ability of teacher education students, there are few studies specifically focusing on improving the TPACK ability of teacher internship students. At the same time, although there are many studies that combine TPACK with subjects, most of the research focuses on Mathematics, English, Geography, Chemistry, etc. There are very few research results that combine TPACK with Chinese subjects. So far, no teacher education students have been found. Research on the improvement of TPACK ability in a certain subject, let alone research on the improvement of TPACK ability of teacher internship students in the teaching practice of Chinese subjects. Through literature review, the author further found that the existing research subjects on TPACK and primary school Chinese teaching practice are all in-service teachers, and the research methods are more biased towards the author's subjective narrative and lack scientific research methods. Therefore, the author believes that it is a very meaningful task to carry out research on strategies to improve the TPACK teaching practice ability of teacher internship students. This study will use testing, interviews and other methods to understand the TPACK-related data

of primary school Chinese teacher education students during the educational internship stage, and develop effective strategy to improve the TPACK abilities of primary school Chinese teacher education students based on constructivism theory, teacher reflection theory, and learning community theory. through pre- and post-internship, pre- and post-test comparison of teacher internship students' TPACK ability, expert CIPP assessment, to verify the effectiveness of the strategy.

Chapter 3
Research Methodology

A mixed research method was used in this study. The study was divided into 3 phases.

Phase 1: To explore the current problem of TPACK ability for teacher internship students.

Phase 2: To develop strategy of TPACK ability for teacher internship students.

Phase 3: To evaluate the improvement strategy of TPACK ability for teacher internship students.

Phase 1: To explore the current problem of TPACK ability for teacher internship students

The Population/ Sample Group

The Population

A class of 55 junior college teacher internship students in elementary education at a normal university in Guangxi.

Sample Group

According to the principle of targeted sampling, the sample is the same as the population.

Research Instruments

1. Develop 2 test papers and 1 grading criterion to measure the TPACK ability of teacher internship students. One test paper is administered before the internship, and the other test paper is administered after the internship.

2. Develop expert assessment form 1 (test paper assessment, two copies) and expert assessment form 2 (grading assessment) and ask five experts to assess the quality and rationality of the two test papers and the grading criterion respectively.

Designing instrument

Step 1. Learn the principles of test paper propositions. The test paper must be consistent with the teaching objectives and have practical application.

Step 2. Design test questions to evaluate TPACK of primary school Chinese teaching for teacher education students. The test questions are related to three types of courses: First, modern educational technology courses. The second is a course on primary school Chinese teaching methods. The third is courses related to Chinese subjects. The topics of these three types of courses correspond to TK, PK, and CK in TPACK respectively, and the integration and application of the three types of courses correspond to TPK, PCK, TCK, and TPCK respectively.

Step 3. In order to ensure the quality of the test questions and reflect the representativeness and authority of the test questions, the researchers will use “Modern Educational Technology” (Shaanxi Normal University, Fujian Normal University, Henan University) and “Basics of Information Technology” (Hebei Normal University) from the Chinese university MOOC platform University, Wuxi Commercial Vocational and Technical College, Changzhou Information Vocational and Technical College), “Curriculum and Teaching Theory” (Shaanxi Normal University), “Teaching Theory” (Beijing Normal University), “Information Teaching Design” (East China Normal University), Choose appropriate questions from the final examination questions of more than 20 national quality courses such as “Primary School Chinese Teaching Design” (Hunan First Normal University), “College Chinese” (Northwestern University, Southeast University, East China Normal University) and other related The question format and content of the questions were adapted, and the difficulty of the questions was matched as much as possible with the level of the students in the researcher's school.

Step 4. Make sure that the two test papers are at the same level in terms of knowledge point coverage, difficulty, question volume, question type, etc., and the questions in the two test papers cannot be repeated.

Step 5. Preliminarily formulate the test paper.

Step 6. Based on the preliminary test paper, the statistics of question types, question volume and scores are as follows: The question types of the two test papers only include multiple-choice questions, with single-choice questions and multiple-choice questions, ranging from TK, PK, CK , TPK, PCK, TCK, and TPCK. There

are questions in seven dimensions. The number of questions in each dimension ranges from 5 to 7. There are 36 questions in total. Among them, single-choice questions are worth 2 points per question, and multiple-choice questions are worth 4 points per question. The total score is 100 points. Only one of the multiple-choice questions meets the question requirements. Correct answers will be scored. Wrong answers or no answers will not be scored. Correct answers to multiple-choice questions will be scored; no points will be awarded for multiple choices, few choices, wrong choices, or no choices.

Step 7. Make an expert assessment form 1 to evaluate the test paper. Experts will determine whether the test questions are consistent with what they have learned in college, the difficulty of the test questions, the coverage requirements of the test questions, the question structure and score distribution requirements, the test question volume requirements, the repetition rate, question volume, and difficulty requirements of the two test papers, and the test paper scoring standards. The test paper is evaluated in 8 aspects, including whether it is scientific and feasible, and whether there are any errors in the test paper.

Step 8. Based on the scores of each dimension of the test paper and the assessment standards of the hundred-point examination, the assessment standards for each dimension of the TPACK test for teacher internship students are formulated.

Step 9. Make an expert assessment form 2 to evaluate the grade assessment standards.

Step 10. Invite 5 relevant experts to evaluate the test paper and grade assessment standards. Among the five experts, one is the vice dean in charge of teaching in the School of Educational Sciences, and is also a part-time teacher in the primary school education major in Chinese. The other four are all teachers in the Chinese teaching and research section of the primary school education major. They have associate senior professional titles or above. They have more than 15 years of working experience in related industries. They have rich Chinese teaching experience and have excellent experience in integrating information technology and Chinese courses.

Step 11. Revise the test papers and grading criteria based on expert evaluation feedback until approval is obtained from the experts.

Step 12. Before the internship begins, the class teacher is invited to organize

55 teacher internship students in the Chinese direction of primary education to take the TPACK ability test. The class teacher randomly selects one of the two test papers for the test. The test paper that is not selected will be used as the post-test paper after the internship.

Step 13. Score the test paper according to the reference answers of the test paper and calculate the test scores.

Step 14. Analyze the TPACK test situation of this teacher internship students from the overall and different dimensions.

Data Collection 1

1. Obtain permission for data collection.

2. Expert assessment form 1.

3. Expert assessment form 2.

4. Administers on-the-spot examinations to designated teacher internship students using developed test questions.

5. Corrects test papers and tallies scores according to grading rubrics.

Data Analysis 1

1. Mean score and standard deviation.

2. The average score and standard deviation of each dimension.

Expected Output Phase 1

Teacher internship students' TPACK ability status

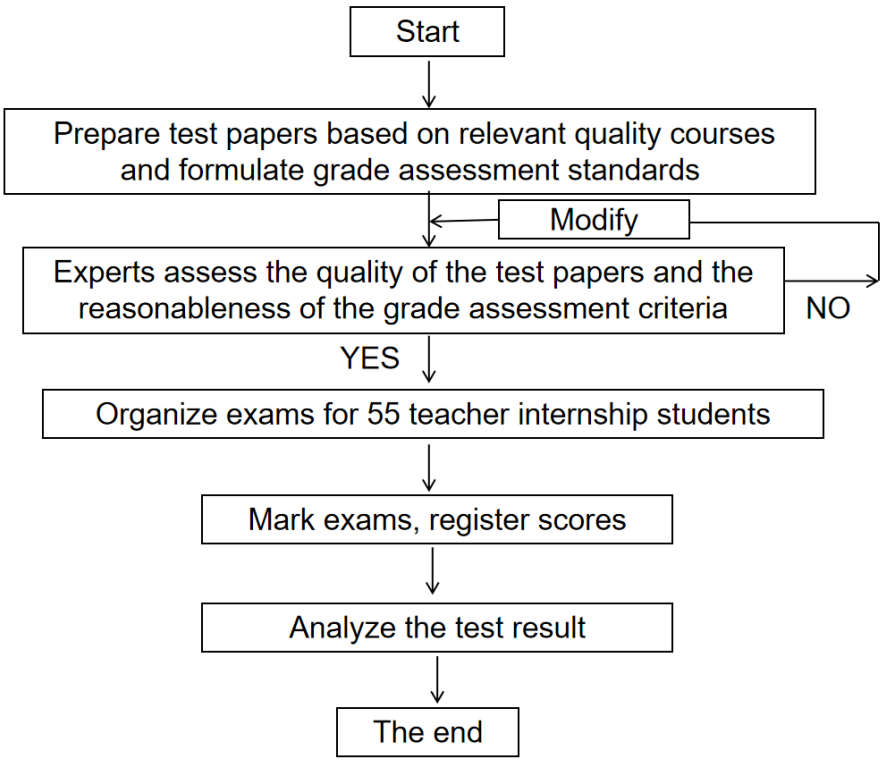


Figure 3.1 Flow chart to achieve Objective 1

Phase 2: To develop strategy of TPACK ability for teacher internship student.

The population /Sample Group

The Population

Research papers related to influencing factors and improvement strategy of teacher internship students' TPACK.

Sample Group

High-quality research papers related to influencing factors and improvement strategy of teacher internship students' TPACK.

Research instrument

1. Literature research
2. Expert assessment form 3

Designing instrument

Step 1. Using "TPACK" and "pre-service teacher" and "education internship" as the subject words, search relevant high-quality literature on China National Knowledge Infrastructure and web of science to obtain insights from Chinese and foreign scholars about internships, Influencing factors and development strategy for teacher TPACK research.

Step 2. Read each document carefully, extract information about the influencing factors and improvement strategy of TPACK, and pay attention to the research methods, research results and suggestions in the literature.

Step 3. Integrate information obtained from different literature.

Step 4. Analyze the integrated influencing factors of TPACK for teacher education students and TPACK improvement strategy, sort them according to their importance, combine the TPACK test situation of teacher education students obtained in goal 1 of this study, and considering the characteristics of the educational internship stage, a TPACK improvement strategy for teacher internship students suitable for the educational internship stage is initially formulated.

Step 5. Design the steps to implement the TPACK development strategy for teacher internship students.

Step 6. Create an expert assessment form 3 for experts to evaluate primary school teacher internship students' TPACK improvement strategy.

Step 7. Organize 5 experts to evaluate the designed strategy. Experts will assess the development basis, formulation principles, specific content, and effectiveness testing of the internship teachers' TPACK enhancement strategies from four aspects: practicality, feasibility, appropriateness, and accuracy.

Step 8. Based on expert evaluation opinions, decide whether to improve or adjust the strategy.

Step 9. Get a strategy that meets the standards of feasibility and applicability based on expert opinions.

Data Collection

1. CNKI, Web of Science, Google scholar.
2. Expert assessment form 3.

Data Analysis

1. Content Analysis.
2. Expert assessment data on TPACK development strategy.

Expected Output Phase 2

1. Factors influencing the development of teacher internship students' TPACK.
2. Improvement strategy on TPACK ability for teacher internship students.

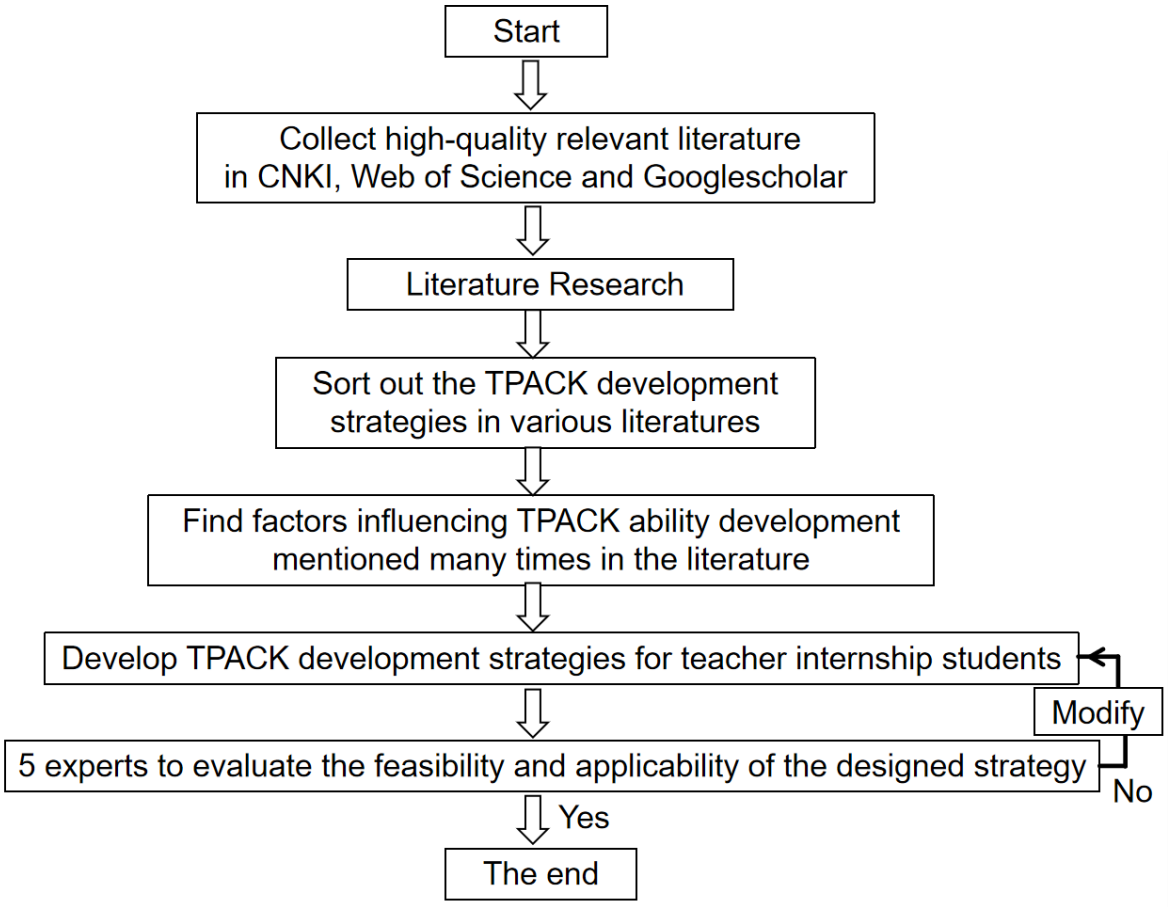


Figure 3.2 Flow chart to achieve Objective 2

Phase 3: To evaluate the improvement strategy of TPACK ability for teacher internship student

The Population / Sample Group

The Population

A class of 55 teacher internship students in elementary education at a normal university in Guangxi.

Sample Group

According to the principle of targeted sampling, the sample is the same as the population.

Research instruments

1. Expert assessment form 4.
2. Test Paper 2 assessed as passing.
3. Expert assessment form 5.

Designing instrument

Step 1. Based on the analysis of many mature TPACK measurement questionnaire, the assessment criteria for the TPACK ability of Chinese teacher internship students in each dimension are formulated, and the performance of TPACK in five grades of excellent, good, medium, passable and poor is clearly described, used to evaluate the TPACK ability of primary school Chinese teachers.

Step 2. Design expert assessment form 4, which is used for experts' assessment of TPACK ability assessment criteria.

Step 3. Five experts were invited to evaluate the TPACK ability assessment criteria. Assessment experts need to have more than 15 years of working experience in the education industry, rich experience in Chinese teaching, and excellent performance in the integration of information technology and Chinese courses. In this study, the assessment experts for the TPACK ability assessment criteria and the assessment experts for the TPACK test paper were the same group of experts.

Step 4. Give the TPACK ability assessment criteria of expert assessment form 4 to the 5 experts.

Step 5. Collect opinions from five experts and decide whether to adjust the TPACK evaluation criteria based on their feedback.

Step 6. Strategy is implemented in a planned way during the education internship process for teacher internship students.

Step 7. Test paper 2 for assessing teacher internship students' TPACK in primary school Chinese teaching, with the same rules and difficulty level as Objective 1, but with different questions.

Step 8. At the end of the internship, Organized 55 teacher internship students again for testing.

Step 9. Marking of examination papers based on the grading rubrics to the papers and counting the examination results of the teacher internship students.

Step 10. Design expert assessment form 5 for experts to assess the outcomes of the TPACK enhancement strategy.

Step 11. Organize 5 experts to conduct CIPP assessment. The assessment includes the assessment of teacher internship students' TPACK ability before education internship, the specific content of the strategy, the strategy implementation process, the strategy implementation results, etc.

Step 12. Based on the expert CIPP assessment results, further improve the strategy and adjust the implementation process of the strategy.

Data Collection

1. Obtain permission for data collection.

2. Administer on-the-spot exams to designated teacher internship students using developed Test paper 2.

3. Correct the test papers and tally the scores according to the grading rubric.

4. Expert assessment data on TPACK assessment criteria.

5. Expert CIPP evaluation data.

Data Analysis

1. Mean score and standard deviation.

2. The average score and standard deviation of each dimension.

Expected Output Phase 3

Results of teacher internship students' TPACK ability development

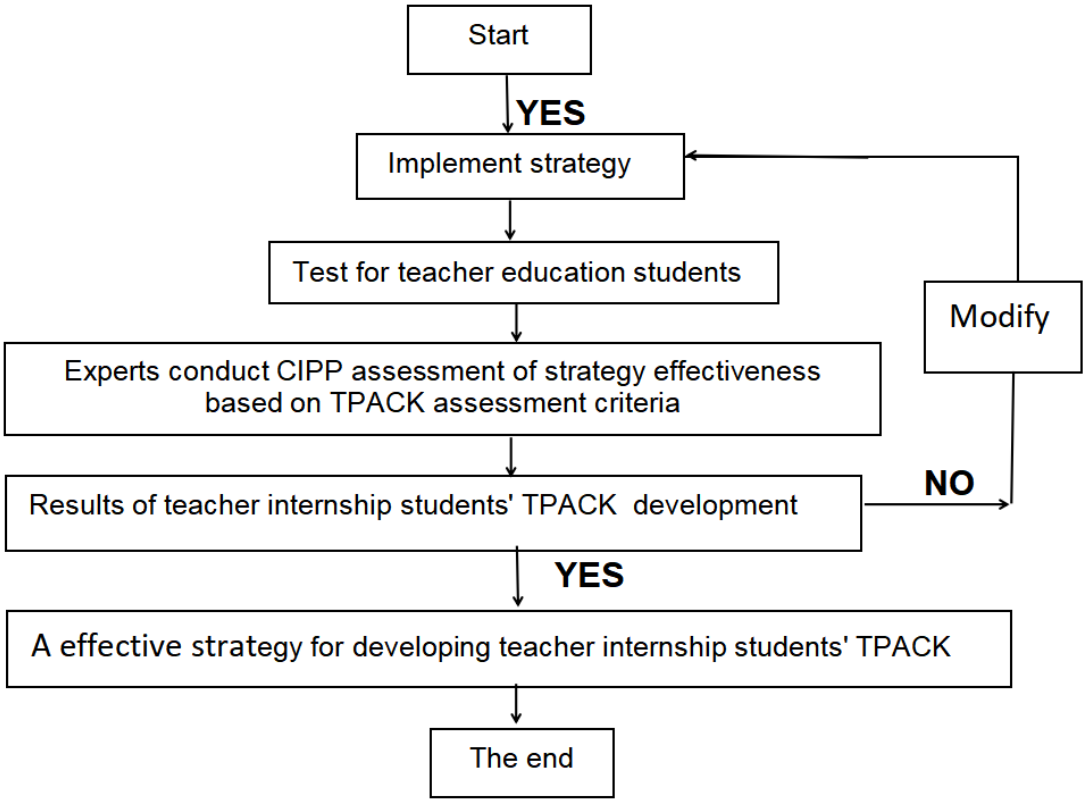


Figure 3.3 Flow chart to achieve Objective 3

Chapter 4
Results of Analysis

In the study of "Teacher internship student improvement strategy development on TPACK teaching practice", the research studied the documents concerning the following.

Part 1: Analysis results serving objective 1-To explore the current problem of TPACK ability for teacher internship students.

Part 2: Analysis results serving objective 2-To develop strategy of TPACK ability for teacher internship students.

Part 3: Analysis results serving objective 3-To evaluate the improvement strategy of TPACK ability for teacher internship students.

Data Analysis Results

Part 1: Analysis results serving objective 1-To explore the current problem of TPACK ability for teacher internship students

1. Expert assessment results of TPACK test papers and grading criteria

To better understand the TPACK abilities of elementary education Chinese majors teacher internship students during their teaching internship at the researcher's school, two test papers were designed by the researcher before the internship. Five experts from the researcher's college were invited to assess the paper’s quality. Among the experts, one was the vice dean responsible for teaching at the College of Education, also serving as a part-time teacher in elementary education Chinese, and the other four were teachers from the Chinese teaching and research office, each with over 15 years of experience in the field, demonstrating excellent performance in integrating information technology with Chinese courses. The researcher presented the assessment sheets and evaluation criteria to the experts, and the summarized opinions are as follows:

(1) Expert assessment of the test papers

Table 4.1 Expert assessment results of TPACK test papers

No.	Item	Opinion of the experts					
		Agree		Partially Agree		Disagree	
		F	P	F	P	F	P
1	The test questions are consistent with what you studied in college	5	100%	0	0%	0	0%
2	Test question difficulty	5	100%	0	0%	0	0%
3	Test question coverage requirements	5	100%	0	0%	0	0%
4	Test question structure and score distribution requirements	4	80%	1	20%	0	0%
5	Test question volume requirements	5	100%	0	0%	0	0%
6	Repetition rate, question volume, and difficulty requirements for the two test papers	5	100%	0	0%	0	0%
7	The test paper's scoring standards are scientific and feasible	5	100%	0	0%	0	0%
8	The test paper has no errors	5	100%	0	0%	0	0%

Note: F refers to Frequency; P refers to Percentage.

The Whole quality of the two test papers is considered high. They comprehensively cover five major areas of primary Chinese teaching: character recognition and writing, reading, composition, oral communication, and comprehensive activities. The questions are contextually relevant to the actual teaching situations, highlighting applicability and assessing the abilities of teacher education students. The quantity and difficulty of the questions are appropriate. Both papers share the same difficulty level, question quantity, and structure. All five experts unanimously agree that the test papers effectively evaluate the TPACK abilities of teacher education students. However, there are issues with the point allocation that need adjustment based on the following suggestions:

Point 1: Unreasonable points distribution.

The points distribution is considered unreasonable. Multiple-choice questions carry too much weight, and it is recommended to reduce their quantity. Despite a higher quantity of single-choice questions, multiple-choice questions account for 56 points, while single-choice questions only make up 44 points. It is suggested that each dimension of multiple-choice questions should not exceed one, and the total points for multiple-choice questions should be kept within 30 points.

Point 2: Subjective nature of TPACK questions.

Questions related to the TPACK dimension should be set as subjective questions, such as designing a lesson plan for elementary Chinese information technology teaching. Considering that this test is for research purposes and not a mandatory test for teacher education students, students may not fully cooperate in answering subjective questions. It is recommended to reduce the points for this dimension to within 10 points. TPACK abilities can be reflected in internship materials such as lesson plans, instructional videos, and teaching reflections.

Point 3: Adjustment of point allocation.

Point allocation should be adjusted to emphasize the assessment of students' knowledge transfer abilities. Recall-type single-choice questions or relatively easier single-choice questions should be set at 2 points each, while application-type single-choice questions or relatively difficult single-choice questions should be set at 3 points each. Multiple-choice questions should be set at 4 points each.

(2) Expert opinions on TPACK grading criteria:

Table 4.2 Expert assessment results of TPACK whole and dimension-specific grading criteria

No.	Item	Opinion of the experts					
		Agree		Partially Agree		Disagree	
		F	P	F	P	F	P
1	Whole	5	100%	0	0%	0	0%
2	TK Dimension	5	100%	0	0%	0	0%
3	PK Dimension	5	100%	0	0%	0	0%
4	CK Dimension	5	100%	0	0%	0	0%
5	TPK Dimension	5	100%	0	0%	0	0%
6	TCK Dimension	5	100%	0	0%	0	0%
7	PCK Dimension	5	100%	0	0%	0	0%
8	TPCK Dimension	5	100%	0	0%	0	0%

The TPACK proficiency test has a maximum score of 100 points. The commonly used domestic grading criteria for course assessments are as follows: scores above 90 are considered excellent, 80-89 are good, 70-79 are average, 60-69 are passable, and below 60 are poor. This grading standard is deemed reasonable and widely representative. Given that TPACK is not a single course, but a combination of many courses, the exam is more difficult than a single course. Therefore, the grading scale should be based on a 10-point scale lower than the one commonly used in the country for course assessment, i.e., scores above 80 are considered excellent, 70-79 are good, 60-69 are average, 50-59 are passable, and less than 50 are poor. The range of scores for the seven dimensions of competency levels is determined according to this standard.

The researcher adjusted the test papers and scoring criteria based on expert assessment opinions, as follows:

(1) Adjusted test papers: The question types of the two test papers only include multiple-choice questions, with two forms: single-choice questions and multiple-choice questions. Questions are drawn from seven dimensions: TK, PK, CK, TPK, PCK, TCK, and TPCK, the number of questions in each dimension ranges from 3

to 7, with a total of 39 questions. Among them, single-choice questions on recognition or relatively low difficulty are 2 points per question, and single-choice questions on knowledge transfer or relatively difficult ones are worth 2 points each. Higher single-choice questions are worth 3 points per question, multiple-choice questions are worth 4 points per question, and the total score is 100 points. Only one of the multiple-choice questions meets the question requirements. Correct answers will be scored. Wrong answers or no answers will not be scored. Correct answers to multiple-choice questions will be scored; no points will be awarded for multiple choices, few choices, wrong choices, or no choices.

Table 4.3 Revised TPACK test question dimensions, question volume and score distribution table based on expert evaluation opinions

Dimensions	Quantity of questions		Score
	Single choice questions	Multiple choice questions	
TK	6	1	17
PK	6	1	16
CK	4	1	15
TPK	5	1	14
TCK	5	1	14
PCK	4	1	16
TPCK	2	1	8
Total	32	7	100

Adjusted grading criteria: Due to modifications in the test paper, changes have been made to the scores for each dimension. The revised evaluation criteria are detailed in table 4.4.

Table 4.4 The grading criteria for the TPACK test for teacher internship students have been revised based on expert assessment feedback

Grade	Score						
	TK	PK	CK	TPK	TCK	PCK	TPCK
Excellent	14-17	14-16	13-15	12-14	12-14	14-16	7-8
Good	11-13	11-13	10-12	10-11	10-11	11-13	6
Average	9-10	9-10	8-9	8-9	8-9	9-10	5
Passable	7-8	7-8	6-7	6-7	6-7	7-8	4
Poor	<7	<7	<6	<6	<6	<7	<4

2. TPACK pre-test results for primary school teacher internship students

According to the research needs, the researcher entrusted the head teacher of the Chinese direction in elementary education to organize all students (55 people) to take the TPACK ability test when the students started their educational internship. The head teacher randomly selected one test paper from the two test papers as the pre-test paper. The remaining test paper will automatically serve as the post-test paper. The exam is a closed-book format, with a maximum score of 100 points, and a duration of 1 hour. The test results are shown in Table 4.5, Table 4.6, Figure 4.1, and Figure 4.2.

Table 4.5 The pre-test results of TPACK for primary school teacher internship students

Dimension	Full score	Highest score	Lowest score	Standard deviation	Average accuracy	Ranking of accuracy in each dimension
Whole	100	66	32	8.08	48.3%	
TK	17	11	0	2.44	30.5%	1
PK	16	14	2	2.88	59.3%	6
CK	15	15	3	3.29	55.4%	5
TPK	14	12	2	2.07	43.1%	3
TCK	14	14	4	2.89	61.0%	7
PCK	16	13	0	2.53	46.0%	4
TPCK	8	6	0	1.58	41.8%	2

Table 4.6 TPACK pre-test for primary school teacher internship students

Dimensions	Score	Question	Score	$\overline{X}$	σ	$\overline{X}$	σ	$\overline{X}$	σ
TK	17	Q1	2	0.47	0.85	5.18	2.44	48.28	8.08
		Q2	2	0.44	0.83				
		Q3	2	1.27	0.96				
		Q4	2	0.80	0.98				
		Q5	3	1.04	1.43				
		Q6	2	0.95	1.00				
		Q33	4	0.22	0.91				
PK	16	Q7	2	1.13	0.99	9.49	2.88		
		Q8	2	0.22	0.62				
		Q9	2	1.71	0.71				
		Q10	2	1.53	0.85				
		Q11	2	0.11	0.45				
		Q12	2	1.82	0.57				
		Q34	4	2.98	1.74				
CK	15	Q13	3	2.13	1.36	8.31	3.29		
		Q14	2	0.76	1.31				
		Q15	3	1.38	0.92				
		Q16	3	2.95	0.40				
		Q35	4	1.09	1.78				
TPK	14	Q17	2	1.89	0.45	6.04	2.07		
		Q18	2	0.73	0.96				
		Q19	2	1.20	0.98				
		Q20	2	1.67	0.74				
		Q21	2	0.25	0.67				
		Q36	4	0.29	1.04				
TCK	14	Q22	2	1.82	0.57	8.55	2.89		
		Q23	2	1.38	0.92				
		Q24	2	0.65	0.94				
		Q25	2	1.16	0.99				
		Q26	2	1.42	0.91				
		Q37	4	2.11	2.00				

Table 4.6 (Continued)

Dimensions	Score	Question	Score	$\overline{X}$	σ	$\overline{X}$	σ	$\overline{X}$	σ
PCK	16	Q27	3	1.47	1.50	7.36	2.53		
		Q28	3	1.53	1.50				
		Q29	3	0.44	1.06				
		Q30	3	1.09	1.44				
		Q38	4	2.84	1.82				
TPCK	8	Q31	2	1.16	0.99	3.35	1.58		
		Q32	2	1.38	0.92				
		Q39	4	0.80	1.60				

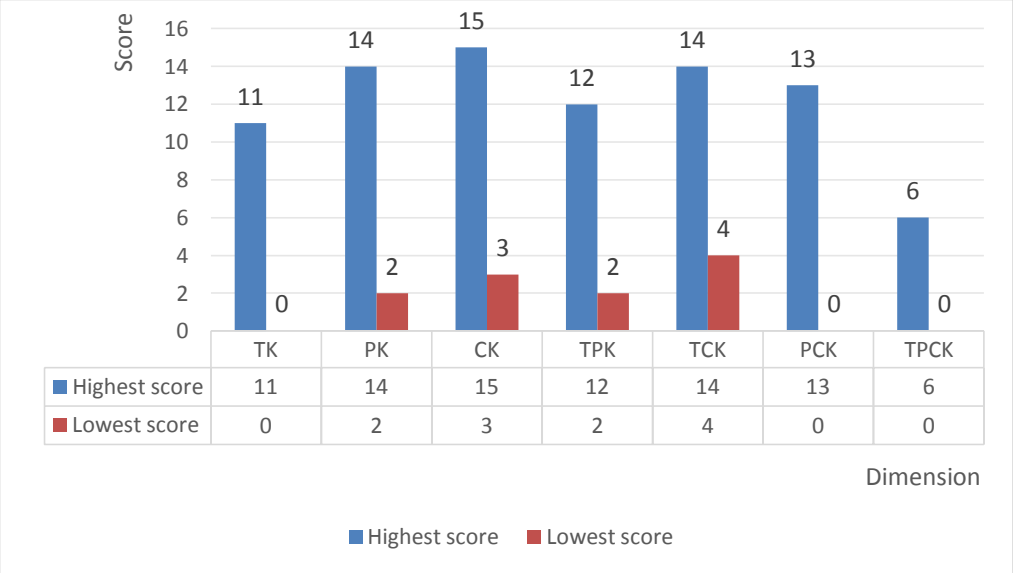


Figure 4.1 The highest and lowest scores in each dimension of the TPACK pre-test for teacher internship students

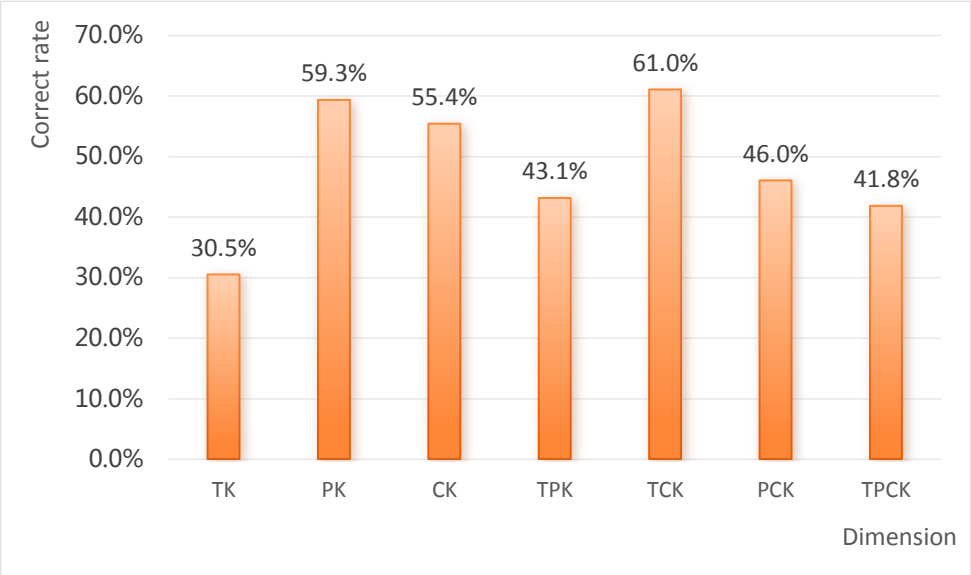


Figure 4.2 The average accuracy rate of each dimension in the TPACK pre-test for teacher internship students

The pre-test results of TPACK for elementary education major teacher internship students across seven dimensions are shown in Table 4.7.

Table 4.7 Frequency and percentage of each dimension and level of TPACK pre-test for primary school teacher internship students

Grade	Frequency													
	TK		PK		CK		TPK		TCK		PCK		TPCK	
Excellent	0	0.0%	4	7.3%	6	10.9%	1	1.8%	11	20.0%	0	0.0%	0	0.0%
Good	1	1.8%	16	29.1%	12	21.8%	4	7.3%	14	25.5%	3	5.5%	6	10.9%
Average	4	7.3%	14	25.5%	15	27.3%	9	16.4%	13	23.6%	15	27.3%	0	0.0%
Passable	10	18.2%	10	18.2%	10	18.2%	25	45.5%	9	16.4%	20	36.4%	30	54.5%
Poor	40	72.7%	11	20.0%	12	21.8%	16	29.1%	8	14.5%	17	30.9%	19	34.5%

It can be seen from Table 4.6 and Table 4.7 that the performance of primary school teacher internship students in each dimension and at each level is as follows:

In the TK dimension, Whole performance is at a "Poor" level (average score of 5.18). Among the 55 students, none achieved an excellent rating in the TK dimension, accounting for 0.0%; 1 students received a good rating, constituting 1.8%;

4 students obtained an average rating, making up 7.3%; 10 students achieved a passable rating, accounting for 18.2%; and 40 students received a poor rating, representing 72.7%.

In the PK dimension, Whole performance is at a "Average" level (average score of 9.49). Among the 55 students, 4 students achieved an excellent rating in the PK dimension, accounting for 7.3%; 16 students received a good rating, constituting 29.1%; 14 students obtained an average rating, making up 25.5%; 10 students achieved a passable rating, accounting for 18.2%; and 11 student received a poor rating, representing 20.0%.

In the CK dimension, Whole performance is at a "Average" level (average score of 8.31). Among the 55 students, 6 achieved an excellent rating in the CK dimension, accounting for 10.9%; 12 students received a good rating, constituting 21.8%; 15 students obtained an average rating, making up 27.3%; 10 students achieved a passable rating, accounting for 18.2%; and 12 students received a poor rating, representing 21.8%.

In the TPK dimension, Whole performance is at a "Passable" level (average score of 6.04). Among the 55 students, 1 achieved an excellent rating in the TPK dimension, accounting for 1.8%; 4 students received a good rating, constituting 7.3%; 9 students obtained an average rating, making up 16.4%; 25 students achieved a passable rating, accounting for 45.5%; and 16 received a poor rating, representing 29.1%.

In the TCK dimension, Whole performance is at a "Average" level (average score of 8.55). Among the 55 students, 11 achieved an excellent rating in the TCK dimension, accounting for 20.0%; 14 students received a good rating, constituting 25.5%; 13 students obtained an average rating, making up 23.6%; 9 students achieved a passable rating, accounting for 16.4%; and 8 student received a poor rating, representing 14.5%.

In the PCK dimension, Whole performance is at a "Passable" level (average score of 7.36). Among the 55 students, none achieved an excellent rating in the PCK dimension, accounting for 0%; 3 students received a good rating, constituting 5.5%; 15 students obtained an average rating, making up 27.3%; 20 students achieved a passable rating, accounting for 36.4%; and 17 students received a poor rating, representing 30.9%.

In the TPCK dimension, Whole performance is at a "Poor" level (average score of 3.35). Among the 55 students, none achieved an excellent rating in the TPCK dimension, accounting for 0%; 6 received a good rating, constituting 10.9%; none students obtained an average rating, making up 0%; 30 achieved a passable rating, accounting for 54.5%; and 19 students received a poor rating, representing 34.5%.

Table 4.8 The average scores and standard deviations of the TPACK pre-test in the TK dimension for primary school teacher internship students

Dimensions	Score	Question	Score	$\overline{X}$	σ	Correct rate	$\overline{X}$	σ	Correct rate
TK	17	Q1	2	0.47	0.85	23.5%	5.18	2.44	30.5%
		Q2	2	0.44	0.83	22.0%			
		Q3	2	1.27	0.96	63.5%			
		Q4	2	0.80	0.98	40.0%			
		Q5	3	1.04	1.43	34.7%			
		Q6	2	0.95	1.00	47.5%			
		Q33	4	0.22	0.91	5.5%			

Judging from the scores of each question in the TK dimension, Q3 has the highest correct rates, 63.5% respectively, while Q33 has the lowest correct rates, only 5.5%. teacher internship students' $\overline{X}$ score in the TK dimension is 5.18 points, **σ** is 2.44, and the dimension correct rate is 30.5%.

Table 4.9 The average scores and standard deviations of the TPACK pre-test in the PK dimension for primary school teacher internship students

Dimensions	Score	Question	Score	$\overline{X}$	σ	Correct rate	$\overline{X}$	σ	Correct rate
PK	16	Q7	2	1.13	0.99	56.5%	9.49	2.88	59.4%
		Q8	2	0.22	0.62	11.0%			
		Q9	2	1.71	0.71	85.5%			
		Q10	2	1.53	0.85	76.5%			
		Q11	2	0.11	0.45	5.5%			
		Q12	2	1.82	0.57	91.0%			
		Q34	4	2.98	1.74	74.5%			

Judging from the scores of each question in the PK dimension, the correct rates of Q12, Q9 are relatively high, 91.0%, 85.5% respectively, while Q11, Q8 the correct rates for questions are the lowest, only 5.5%, 11.0%. teacher internship students' $\overline{X}$ score in the PK dimension is 9.49 points, **σ** is 2.88, and the dimension correct rate is 59.4%.

Table 4.10 The average scores and standard deviations of the TPACK pre-test in the CK dimension for primary school teacher internship students

Dimensions	Score	Question	Score	$\overline{X}$	σ	Correct rate	$\overline{X}$	σ	Correct rate
CK	15	Q13	3	2.13	1.36	71.0%	8.31	3.29	55.4%
		Q14	2	0.76	1.31	38.0%			
		Q15	3	1.38	0.92	46.0%			
		Q16	3	2.95	0.40	98.3%			
		Q35	4	1.09	1.78	27.3%			

Judging from the scores of each question in the CK dimension, Q16 has the highest correct rate of 98.3%, while Q35 has the lowest correct rate of only 27.3%. teacher internship students' $\overline{X}$ score in the CK dimension is 8.31 points, **σ** is 3.29, and the dimension correct rate is 55.4%.

Table 4.11 The average scores and standard deviations of the TPACK pre-test in the TPK dimension for primary school teacher internship students

Dimensions	Score	Question	Score	$\overline{X}$	σ	Correct rate	$\overline{X}$	σ	Correct rate
TPK	14	Q17	2	1.89	0.45	94.5%	6.04	2.07	43.1%
		Q18	2	0.73	0.96	36.5%			
		Q19	2	1.20	0.98	60.0%			
		Q20	2	1.67	0.74	83.5%			
		Q21	2	0.25	0.67	12.5%			
		Q36	4	0.29	1.04	7.3%			

Judging from the scores of each question in the TPK dimension, Q17, Q20, have relatively high correct rates, 94.5%, 83.5% respectively, while Q36 has the lowest correct rate, only 7.3 %. The $\overline{X}$ score of teacher internship students in the TPK dimension is 6.04, **σ** is 2.07, and the dimension correct rate is 43.1%.

Table 4.12 The average scores and standard deviations of the TPACK pre-test in the TCK dimension for primary school teacher internship students

Dimensions	Score	Question	Score	$\overline{X}$	σ	Correct rate	$\overline{X}$	σ	Correct rate
TCK	14	Q22	2	1.82	0.57	91.0%	8.55	2.89	61.1%
		Q23	2	1.38	0.92	69.0%			
		Q24	2	0.65	0.94	32.5%			
		Q25	2	1.16	0.99	58.0%			
		Q26	2	1.42	0.91	71.0%			
		Q37	4	2.11	2.00	52.8%			

Judging from the scores of each question in the TCK dimension, Q22 has the highest score rate, which is 91.0%, while Q24 has the lowest score rate, 32.5%. The $\overline{X}$ score of teacher internship students in the TPK dimension is 8.55, **σ** is 2.89, and the dimension score rate is 61.1%.

Table 4.13 The average scores and standard deviations of the TPACK pre-test in the PCK dimension for primary school teacher internship students

Dimensions	Score	Question	Score	$\overline{X}$	σ	Correct rate	$\overline{X}$	σ	Correct rate
PCK	16	Q27	3	1.47	1.50	49.0%	7.36	2.53	46.0%
		Q28	3	1.53	1.50	51.0%			
		Q29	3	0.44	1.06	14.7%			
		Q30	3	1.09	1.44	36.3%			
		Q38	4	2.84	1.82	71.0%			

Judging from the scores of each question in the PCK dimension, Q38 has the highest score rate, which is 71.0%, while Q29 has the lowest score rate, which is 14.7%. The $\overline{X}$ score of teacher internship students in the TPK dimension is 7.36 points, **σ** is 2.53, and the dimension score rate is 46.0%.

Table 4.14 The average scores and standard deviations of the TPACK pre-test in the TPCK dimension for primary school teacher internship students

Dimensions	Score	Question	Score	$\overline{X}$	σ	Correct rate	$\overline{X}$	σ	Correct rate
TPCK	8	Q31	2	1.16	0.99	58.0%	3.35	1.58	41.9%
		Q32	2	1.38	0.92	69.0%			
		Q39	4	0.80	1.60	20.0%			

Judging from the scores of each question in the TPCK dimension, the score rate of each question is not high. Q32 has the highest score rate, which is 69.0%; Q39 has the lowest score rate, which is 20.0%. The $\overline{X}$ score of teacher internship students in the TPCK dimension is 3.35 points, **σ** is 1.58, and the dimension score rate is 41.9%.

Part 2: Analysis results serving objective 2-To develop strategy of TPACK ability for teacher internship students

The research employed a literature review as the research tool for its second objective. To ensure the relevance of the identified literature to the research objectives and to maximize the quantity of relevant literature, the researchers utilized various keywords for retrieval. On the China National Knowledge Infrastructure (CNKI) platform, a search using the keywords "TPACK" AND "语文" (Chinese) yielded a total of 11 relevant documents. Another search using "TPACK development" AND "教育实习" (educational internship) resulted in 18 documents. Similarly, a search combining "TPACK development" AND "师范生"(teacher internship student) within the core databases, limited to the period from January 2019 to August 2023, produced 16 documents. A search using "TPACK" AND "influence factor" AND "师范" (teacher education student) generated 16 documents. In total, 61 relevant documents on the specified topics were identified, and after removing 6 duplicates and research review literature, a final set of 55 target documents was obtained; On the Web of Science, use "TPACK" AND "pre-service teacher" searched a total of 75 open source documents in English in the past five years (except for research review literature), and downloaded the full text of 75 documents in Google Scholar.

The researcher read the collected 130 Chinese and English literature one by one according to the research purpose. During the literature reading process, The researcher first eliminated literature irrelevant to the development of TPACK based on the abstract of the paper and the research results, and recorded the literature that met the research purpose. Through literature review, it was found that the literature mainly divides the factors affecting TPACK into personal factors, internal factors and external factors for consideration. Personal factors include teachers' professional identity, motivation and self-efficacy, etc., and internal factors are the seven factors of TPACK (TK, PK , CK, TPK, TCK, PCK, TPCK) on the development of TPACK, external factors such as teachers' teaching demonstration, school resources and environment, teaching practice settings, strength of policy support, curriculum settings, etc., taking into account the seven factors are make major contributions to the development of TPACK (Chen & Deng, 2020; Tang, 2020; Xiong, Zheng & Li, 2020). Therefore, researchers believe that among the many influencing factors, the

improvement of the seven internal factors TPACK is a strategy that is most suitable for research practice. In order to further explore the impact of the seven factors of TPACK on TPACK, the researchers compiled the research results of 23 related documents (15 Chinese documents and 8 English documents) into Table 4.15.

Table 4.15 Analysis of relevant literature on the development of TPACK improvement strategy for primary school teacher internship students

Author	Research conclusions on factors affecting TPACK
Chen & Deng (2020)	In the TPACK framework, the frequencies of mentioning the three individual knowledge components CK, PK, and TK are relatively high, accounting for 27.1%, 27.2%, and 23.2%, respectively. The four integrated knowledge components are mentioned at much lower frequencies, specifically 4.1%, 3.6%, 3.1%, and 6.5%, respectively. **It is believed that the levels of these three individual knowledge components can influence teachers' TPACK levels.**
Gao (2020)	There is a significant positive correlation between the improvement magnitudes of each dimension within TPACK, **especially a high correlation between the improvement magnitudes of TCK and TPK with the improvement magnitudes of other dimensions.**
Zhao (2018)	**TK and PCK have a significant impact on TPACK.**
Zhao (2015)	**TPACK is formed by the integration of PCK and TK.**
Lu (2021)	The factors of **PU (Perceived Usefulness), CK, TCK, TPK, and PCK** have significant explanatory power for the development of TPACK.
Zhang (2022)	In the integration of artificial intelligence technology into subject teaching knowledge (AI-TPACK), pre-service teachers' AI-Technology Knowledge (AI-TK) has a significant direct impact on their AI-Technological Content Knowledge (AI-TCK) and AI-Technological Pedagogical Knowledge (AI-TPK); **Content Knowledge (CK) has a significant direct impact on Pedagogical Content Knowledge (PCK) and AI-TCK; Pedagogical Knowledge (PK) has a significant direct impact on PCK**; Pre-service teachers' AI-TK, CK, AI-TCK, and AI-TPK have a significant direct impact on the development of their AI-TPACK ability.
Tang (2020)	**CK, TK, PK, PCK, TCK, and TPK can explain 71.4% of the variance in the variable TPACK.**
Xiong, Zheng & Li (2020)	The independent variables **CK, PK, TK, PCK, TPK, and TCK explain 73.4% of the variance in TPACK levels.** Regression analysis indicates that improvements in TCK, TPK, PK, TK, and PCK all contribute to the enhan cement of TPACK levels among minority ethnic group pre-service teachers.

Table 4.15 (Continued)

Author	Research conclusions on factors affecting TPACK
Lai (2022)	1.**Strengthen the cultivation of courses related to TK.** 2. Emphasize the development of pre-service teachers' composite knowledge levels. 3. Improve the TK levels of pre-service teachers.
Qin, Pan & Zhang (2022)	The education internship significantly promotes the improvement of TPACK across dimensions; among them, **TPK has the highest correlation with TPACK, and PK is a key factor in enhancing pre-service teachers' TPACK ability.**
Zhang, Li, & Wang (2020)	**TPK, TCK, and CK are the main factors influencing the development of TPACK.**
Li (2020)	**To enhance personal teaching reflection, actively participate in school training, innovate classroom teaching methods,** and for schools to improve the TPACK assessment system for teachers.
Zhang, Zhang & Wang (2016)	**The development of TPK , PCK, TCK and CK levels significantly influences the development of TPACK levels**. Among them, TPK and PCK are the primary influencing factors in the development of TPACK, and **educational internship experiences have a positive impact on the enhancement of PK, PCK, and TPK.**
Jin, Chen & Miu (2021)	Educational internships facilitate the development of TPACK for pre-service mathematics teachers, **particularly in promoting TK, CK, TPK, and PCK. Learning in relevant courses significantly contributes to the development of TPACK** and its various dimensions for pre-service mathematics teachers. The development of TPK and TCK levels has a substantial impact on the overall development of TPACK, with TPK having the greatest influence.
Cao & Yu (2023)	**TPK , PK and PCK significantly contribute to the development of TPACK.**
Valtonen (2022)	**The core role of PK in the development of TPACK.**
Diamah (2022)	**TPACK training programs that facilitate how pre-service teachers integrate technology, content, and pedagogy to create effective technology-enriched learning environments in their subjects should be included in teacher education programs.**
Valtonen (2023)	In order to provide pre-service teachers with better and more balanced support for the development of their TPACK, **we need to highlight technology and make its role more explicit, especially from the perspectives of teachers.**

Table 4.15 (Continued)

Author	Research conclusions on factors affecting TPACK
Ergüleç (2022)	which was designed with the TPACK-based IDM, increased **the TPACK levels of pre-service teachers by associating their TK, PK and CK.**
Baran (2019)	The linear regression analysis revealed a positive relation between teacher education strategies and pre-service teachers' TPACK. **Reflection and teacher educators as role models were the most frequently used teacher education strategies in teacher education programs included in this study.**
Mourlam (2021)	Teacher educators may consider using learning activity types of short courses for pre-service teachers' enacted TPACK development, while using other strategies for self-reported TPACK development.
Lin & Huang (2020)	The paper describes the design of a four-layer model based on the TPACK framework, with each layer representing different knowledge types. **The layers include TK/PK/CK (first layer), TCK/PCK (second layer), TPK (third layer), and TPACK (fourth layer).** The design is considered reasonable and effective. The strategies for improvement were tailored to the characteristics of newly appointed teachers who possess rich professional and technical knowledge but lack teaching knowledge. Twenty training programs targeting seven factors were developed, leading to a significant improvement in network course and teaching video evaluation scores.
Ning (2022)	**Teacher education intervention positively affected TPACK.**

According to the literature analysis, the improvement of TPACK ability is closely related to its seven internal factors. TK, PK, and CK are the basis of TPACK ability. However, the level of TPACK ability also depends on the effective integration of three single factors, namely TCK, TPK, PCK, and TPCK. At the same time, the literature shows that teacher educators' teaching demonstration is an important way for teacher internship students to improve TPACK, and teaching reflection also has a significant impact on the improvement of TPACK. Therefore, during the educational internship stage, courses can be opened to improve the three single factors within TPACK. Strengthen and consolidate the knowledge, and then organize students to observe the classroom teaching of primary school Chinese by excellent teachers in the form of observing instructional videos. After the video, organize the teacher

internship students to reflect on the instructional videos, think about the success of the instructional videos, and analyze the seven TPACK effective integration of factors in teaching, in order to improve the TPACK ability of primary school teacher internship students. By intuitively observing instructional videos, teacher internship students can better understand teaching concepts, methods and techniques, and integrate these experiences into their own teaching practices to promote professional growth and improve teaching standards.

TPACK ability improvement is achieved by setting up scientific and reasonable TPACK course content. The questionnaire used to measure TPACK ability is a relatively widely used tool to measure TPACK ability. Therefore, the researcher believes that the specific content of TPACK course should be consistent with the TPACK ability measurement. Closely related, the ability that TPACK needs to have in the three single factors of TK, PK, and CK should be excavated from the questionnaire measured by TPACK. Based on the currently widely used TPACK test tool developed by Denise A. Schmidt, combined with the Chinese TPACK test tool developed by Li Beibei in the Chinese subject, The researcher determined the specific content of improving TP, PK, and CK for primary school teacher internship students. At the same time, according to the “Compulsory Education Chinese Curriculum Standards” (2022 Edition) issued by the Ministry of Education of the People's Republic of China, six important sections of Character recognition and writing, reading and appreciation, expression and communication, and sorting and exploration in primary school Chinese teaching were selected. The content is used as demonstration teaching content to improve the TPACK ability of primary school teacher internship students in their teaching practice by observing the demonstration teaching of outstanding teachers. Table 4.16 for details.

Table 4.16 The basis and specific content of the TPACK improvement strategy development for primary school teacher internship students

TK dimensions	
Related content of Denise A. Schmidt questionnaire	(1) I know how to solve my own technical problems. (2) I can learn technology easily. (3) I keep up with important new technologies. (4) I frequently play around with the technology. (5) I know about a lot of different technologies. (6) I have the technical skills I need to use technology. (7) I have had sufficient opportunities to work with different technologies.
Related content of Li Beibei questionnaire	(1) I know many different kinds of technologies. (2) I often operate technology. (3) I have the skills required for the technology I use. (4) When I encounter technical problems (such as network connection interruption, video playback format error), I know how to solve it. (5) I can keep up with important new technologies.
Relevant content in this research improvement strategy	(1) Acquisition, processing and processing of teaching resources. (2) PPT Courseware design and beautification. (3) Introduction and application of primary school Chinese related APP functions. (4) Modern teaching environment and application. (5) Methods and troubleshooting of common information. technology teaching equipment. (6) Information and media literacy.
PK dimensions	
Related content of Denise A. Schmidt questionnaire	(1) I know how to assess student performance in a classroom. (2) I can adapt my teaching based upon what students currently understand or do not understand. (3) I can adapt my teaching style to different learners. (4) I can assess student learning in multiple ways. (5) I can use a wide range of teaching approaches in a classroom setting.

Table 4.16 (Continued)

	(6) I am familiar with common student understandings and misconceptions. (7) I know how to organize and maintain classroom management.
Related content of Li Beibei questionnaire	(1) I am able to use a variety of teaching methods in the classroom. (2) I am able to adjust my teaching based on students' current understanding of knowledge. (3) I can adapt my teaching methods to suit different learners. (4) I can use a variety of methods to assess student learning. (5) I know how to organize classroom management.
Relevant content in this research improvement strategy	(1) Related theories of learning. (2) Common teaching methods. (3) Instructional design. (4) Classroom management. (5) Personalized teaching. (6) Teaching evaluation.
CK dimensions	
Related content of Denise A.Schmidt questionnaire	(1) I have sufficient knowledge about literacy. (2) I can use a literary way of thinking. (3) I have various ways and strategy of developing my understanding of literacy.
Related content of Li Beibei questionnaire	(1) I have rich knowledge of Chinese language (basic common sense, basic knowledge, modern reading knowledge, poetry reading knowledge, classical Chinese reading knowledge, composition knowledge). (2) I can use the Chinese way of thinking. (3) I have a strong understanding of Chinese literature.
Relevant content in this research improvement strategy	(1) Pinyin and Chinese character writing. (2) Modern Chinese grammar. (3) Common sense of literature. (4) Cultural and sports knowledge. (5) Reading understands knowledge. (6) Basic writing knowledge.

Table 4.16 (Continued)

TPK, TCK, PCK, TPCK dimensions	
Compulsory education Chinese curriculum standards (2022 edition)	Requirements for the Compulsory Education Chinese Curriculum: (1) Character recognition and writing (Pinyin, Recognizing Chinese characters and Writing Chinese characters). (2) Reading and appreciation (Reading). (3) Expression and communication (Writing,Oral communication). (4) Sorting and exploration (Comprehensive learning).
Relevant content in this research improvement strategy	**Teaching Observation and Reflections** (1) Teaching video: i u ü y w (Pinyin). (2) Teaching video: "Mouth Ear Eye" (Recognizing Chinese characters and Writing Chinese characters). (3) Teaching video: "Autumn" (Reading). (4) Teaching video: Wonderful Imagination (Writing). (5) Teaching video: "We Are Friends" (Oral communication). (6) Teaching video: Chinese Garden 4 (Comprehensive learning). **Requirement: After watching each Teaching video, organize teacher internship students to conduct teaching reflections. Mainly conduct reflection on teaching from the following aspects:** (1) Overall evaluation of the teaching video of this lesson. (2) Evaluation of the teaching content, teaching methods, and technology use of this lesson. (3) Evaluation of the teaching effect of this lesson. (4) How does the teaching video of this class inspire our interns' primary school Chinese teaching? (5) If you were asked to take this class next time, how would you design the teaching?

In order to achieve objective 2 and confirm the appropriateness of the 4 components of the improvement strategy, the collected data were analyzed in 4 aspects: practicality, feasibility, appropriateness and accuracy, and presented by frequency and percentage of experts, as shown in the following table 4.17 and as shown in the description.

Table 4.17 Expert assessment results of designed TPACK improvement strategy

No.	Components of the TPACK improvement strategy	Opinion of the Specialists							
		Utility		Feasibility		Propriety		Accuracy	
		F	P	F	P	F	P	F	P
1	Strategy development basis	5	100	5	100	5	100	5	100
2	Strategy development principles	5	100	5	100	5	100	5	100
3	Strategy development content	5	100	5	100	4	80	4	80
4	Strategy effectiveness assessment	5	100	5	100	5	100	5	100

Note: F refers to Frequency; P refers to Percentage.

Strategy development basis

The strategy development basis is confirmed to be appropriate by 5 specialists 100% of all specialists; feasibility 5 specialists 100%; propriety 5 specialists 100%; and accuracy 5 specialists 100%.

Strategy development principles

The Strategy development principles is confirmed to be appropriate by 5 specialists 100% of all specialists; feasibility 5 specialists 100%; propriety 5 specialists 100%; and accuracy 5 specialists 100%.

Strategy development content

The strategy development content is confirmed to be appropriate by 5 specialists 100% of all specialists; feasibility 4 specialists 80%; propriety 4 specialists 80%; and accuracy 4 specialists 80%. One expert suggested that improvements were

needed in the propriety and accuracy of the strategy. The specific recommendations are as follows:

In terms of propriety: As teacher internship students are distributed across different grade levels in elementary schools, with a predominant focus on lower-grade practicum, it is recommended to enhance the appropriateness of observations. To achieve this, the suggestion is to selectively choose more instructional videos featuring exemplary teachers from lower-grade levels. These videos should specifically address the instructional challenges faced by teacher internship students, facilitating a more straightforward understanding and application of observed content in their own teaching practices.

In terms of accuracy: Training facilitators should employ targeted questioning and guidance during curriculum training sessions. This approach aims to assist teacher internship students in gaining a more accurate understanding of how exemplary teachers apply TPACK. Furthermore, it is advised to incorporate this understanding into the framework of their own teaching practices. The goal is to improve the accuracy of teacher internship students' comprehension of TPACK, facilitating a more effective transformation of acquired knowledge and observational experiences into practical teaching skills.

Strategy effectiveness assessment

The strategy effectiveness assessment is confirmed to be appropriate by 5 specialists 100% of all specialists; feasibility 5 specialists 100%; propriety 5 specialists 100%; and accuracy 5 specialists 100%.

Part 3: Analysis results serving objective 3-To evaluate the improvement strategy of TPACK ability for teacher internship students.

In order to assess the effectiveness of the TPACK ability improvement strategy for teacher internship students as objectively and comprehensively as possible, the researcher adopted three research tools: TPACK assessment criteria, TPACK test and CIPP assessment. Below is the data collected on the three research instruments:

3. Expert' opinions on the assessment criteria

Experts believe that the assessment standards are set into five levels: excellent, good, average, passable and poor. The assessment standards for each level are objective and reasonable, and there are obvious differences in ability among each level. The difference can reflect the different abilities of interns TPACK. This assessment standard provides a clear and comprehensive reference framework for evaluating the TPACK ability of teacher education students, and helps evaluate the performance of teacher education students in technology integration. Five experts assessed the seven dimensions of the TPACK assessment criteria respectively. Four experts agreed with the assessment criteria of the seven dimensions. One expert partially agreed with the assessment criteria of the seven dimensions. The expert suggestions are as follows:

Incorporate more quantifiable indicators into the assessment criteria, such as students' positive responses to instructional scenarios, improvements in vocabulary retention, and other measurable factors. These metrics can provide a more objective reflection of teachers' performance in the realm of TPACK.

Table 4.18 Expert assessment results of TPACK assessment criteria for primary school teacher internship students

No.	Item	Opinion of the experts					
		Agree		Partially Agree		Disagree	
		F	P	F	P	F	P
1	TK Dimension	4	80%	1	20%	0	0%
2	PK Dimension	4	80%	1	20%	0	0%
3	CK Dimension	4	80%	1	20%	0	0%
4	TPK Dimension	4	80%	1	20%	0	0%
5	TCK Dimension	4	80%	1	20%	0	0%
6	PCK Dimension	4	80%	1	20%	0	0%
7	TPCK Dimension	4	80%	1	20%	0	0%

Note: F refers to Frequency; P refers to Percentage.

PACK post-test results for primary school teacher internship students

At the end of the educational internship, teacher internship students will be organized to conduct a TPACK ability test. The post-test papers will be the remaining set of papers. The exam is a closed book exam and lasts for 1 hour. The test results are shown in Table 4.19.

Table 4.19 The post-test results of TPACK for primary school teacher internship students

Dimension	Full score	Highest score	Lowest score	Standard deviation	Average accuracy	Ranking of accuracy in each dimension
Whole	100	94	39	11.68	60.4%	
TK	17	17	3	3.55	58.1%	5
PK	16	16	4	2.64	63.4%	3
CK	15	15	5	2.46	59.5%	4
TPK	14	14	2	3.12	50.1%	7
TCK	14	12	6	1.72	72.7%	1
PCK	16	16	6	2.30	57.4%	6
TPCK	8	8	2	2.05	63.6%	2

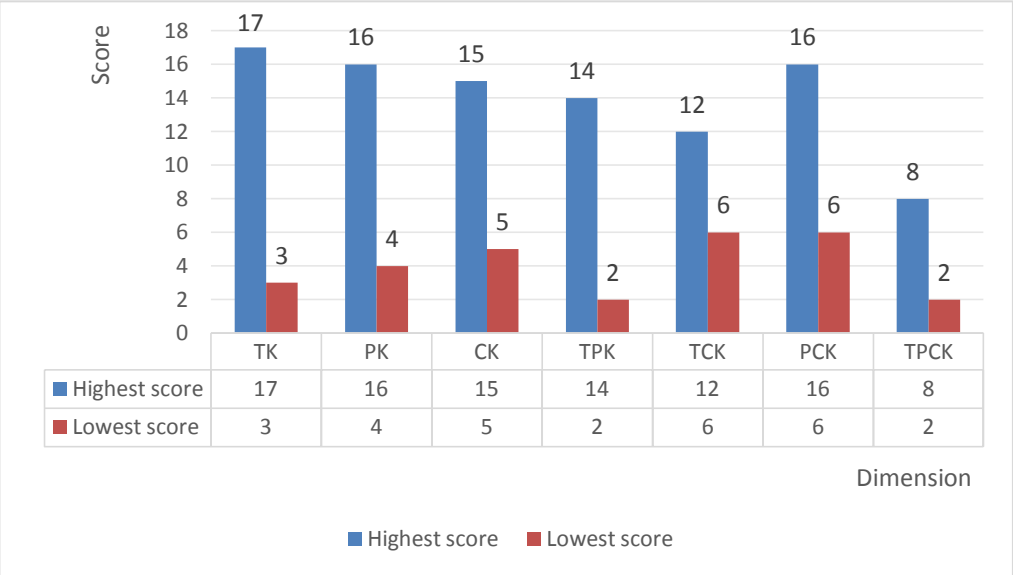


Figure 4.3 The highest and lowest scores in each dimension of the TPACK post-test for teacher internship students

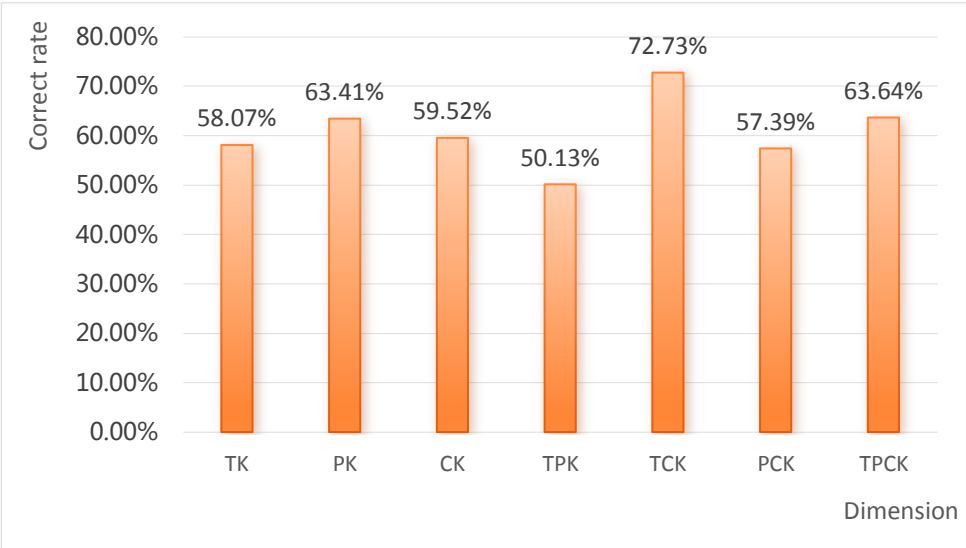


Figure 4.4 The average accuracy rate of each dimension in the TPACK post-test for teacher internship students

Table 4.20 TPACK post-test results after the internship

Dimensions	Score	Question	Score	$\overline{X}$	σ	$\overline{X}$	σ	$\overline{X}$	σ
TK	17	Q1	2	1.82	0.57	9.87	3.55	60.42	11.68
		Q2	2	0.80	0.98				
		Q3	2	0.87	0.99				
		Q4	2	1.13	0.99				
		Q5	2	1.20	0.98				
		Q6	3	2.89	0.56				
		Q33	4	1.16	1.82				
PK	16	Q7	2	1.38	0.92	10.15	2.64		
		Q8	2	1.82	0.57				
		Q9	2	1.31	0.95				
		Q10	2	0.51	0.87				
		Q11	2	1.78	0.62				
		Q12	2	1.45	0.89				
		Q34	4	1.89	2.00				
CK	15	Q13	3	1.36	1.49	8.93	2.46		
		Q14	3	1.53	1.50				
		Q15	3	1.20	1.47				
		Q16	2	1.56	0.83				
		Q35	4	3.27	1.54				
TPK	14	Q17	2	1.42	0.91	7.02	3.12		
		Q18	2	0.84	0.99				
		Q19	2	1.89	0.45				
		Q20	2	0.98	1.00				
		Q21	2	0.87	0.99				
		Q36	4	1.02	1.74				
TCK	14	Q22	2	1.38	0.92	10.18	1.72		
		Q23	2	1.16	0.99				
		Q24	2	1.45	0.89				
		Q25	2	1.09	1.00				
		Q26	2	1.16	0.99				
		Q37	4	3.93	0.53				

Table 4.20 (Continued)

Dimensions	Score	Question	Score	$\overline{X}$	σ	$\overline{X}$	σ	$\overline{X}$	Σ
PCK	16	Q27	3	1.33	1.49	9.18	2.30		
		Q28	3	0.93	1.39				
		Q29	3	2.45	1.16				
		Q30	3	2.24	1.31				
		Q38	4	2.25	1.98				
TPCK	8	Q31	2	1.71	0.71	5.09	2.05		
		Q32	2	0.55	0.89				
		Q39	4	2.84	1.82				

The following is an analysis of the test results of teacher internship students in the seven dimensions of TK, PK, CK, TPK, TCK, PCK, and TPCK after the educational internship.

Table 4.21 Post-test results on seven dimensions of TPACK post-test for teacher internship students

Grade	Frequency													
	TK		PK		CK		TPK		TCK		PCK		TPCK	
Excellent	7	12.7%	9	16.4%	4	7.3%	6	10.9%	21	38.2%	2	3.6%	8	14.5%
Good	20	36.4%	8	14.5%	9	16.4%	6	10.9%	20	36.4%	7	12.7%	27	49.1%
Average	8	14.5%	18	32.7%	26	47.3%	10	18.2%	12	21.8%	28	50.9%	0	0.0%
Passable	12	21.8%	16	29.1%	14	25.5%	20	36.4%	2	3.6%	15	27.3%	8	14.5%
Poor	8	14.5%	4	7.3%	2	3.6%	13	23.6%	0	0.0%	3	5.5%	12	21.8%

In the TK dimension, Whole performance is at "Average" level (average score of 9.87). Among the 55 students, 7 students achieved an excellent rating in the TK dimension, accounting for 12.7%; 20 students received a good rating, constituting 36.4%; 8 students obtained an average rating, making up 14.5%; 12 students achieved a passable rating, accounting for 21.8%; and 8 students received a poor rating, representing 14.5%.

In the PK dimension, Whole performance is at "Average" level (average score of 10.15). Among the 55 students, 9 students achieved an excellent rating in the PK dimension, accounting for 16.4%; 8 students received a good rating, constituting 14.5%; 18 students obtained an average rating, making up 32.7%; 16 students achieved a passable rating, accounting for 29.1%; and 4 students received a poor rating, representing 7.3%.

In the CK dimension, Whole performance is at "Average" level (average score of 8.93). Among the 55 students, 4 student achieved an excellent rating in the CK dimension, accounting for 7.3%; 9 students received a good rating, constituting 16.4%; 26 students obtained an average rating, making up 47.3%; 14 students achieved a passable rating, accounting for 25.5%; and 2 students received a poor rating, representing 3.6%.

In the TPK dimension, Whole performance is at "Passable" level (average score of 7.02). Among the 55 students, 6 students achieved an excellent rating in the TPK dimension, accounting for 10.9%; 6 students received a good rating, constituting 10.9%; 10 students obtained an average rating, making up 18.2%; 20 student achieved a passable rating, accounting for 36.4%; and 13 students received a poor rating, representing 23.6%.

In the TCK dimension, Whole performance is at "Good" level (average score of 10.18). Among the 55 students, 21 students achieved an excellent rating in the TCK dimension, accounting for 38.2%; 20 students received a good rating, constituting 36.4%; 12 students obtained an average rating, making up 21.8%; and 2 students achieved a passable rating, accounting for 3.6%; and none achieved a poor rating, representing 0%.

In the PCK dimension, Whole performance is at "Average" level (average score of 9.18). Among the 55 students, 2 students achieved an excellent rating in the PCK dimension, accounting for 3.6%; 7 students received a good rating, constituting 12.7%; 28 students obtained an average rating, making up 50.9%; 15 students achieved a passable rating, accounting for 27.3%; and 3 students received a poor rating, representing 5.5%.

In the TPCK dimension, Whole performance is at "Average" level (average score of 5.09). Among the 55 students, 8 students achieved an excellent rating in the TPCK dimension, accounting for 14.5%; 27 students received a good rating,

representing 49.1%; none obtained an average rating, making up 0%; 8 students achieved a passable rating, representing 14.5%; and 12 students received a poor rating, representing 21.8%.

Table 4.22 The average scores and standard deviations of the TPACK post-test in the TK dimension for primary school teacher internship students

Dimensions	Score	Question	Score	$\overline{X}$	σ	Correct rate	$\overline{X}$	σ	Correct rate
TK	17	Q1	2	1.82	0.57	90.9%	9.87	3.55	58.1%
		Q2	2	0.80	0.98	40.0%			
		Q3	2	0.87	0.99	43.6%			
		Q4	2	1.13	0.99	56.4%			
		Q5	2	1.20	0.98	60.0%			
		Q6	3	2.89	0.56	96.4%			
		Q33	4	1.16	1.82	29.1%			

Judging from the scores of each question in the TK dimension, 2 of the 7 questions have a score rate higher than 90%, but Q33 has the lowest score rate, 29.1%. Teacher internship students' $\overline{X}$ score in the TK dimension is 9.87 points, **σ** is 3.35, and the dimension score rate is 58.1%.

Table 4.23 The average scores and standard deviations of the TPACK post-test in the PK dimension for primary school teacher internship students

Dimensions	Score	Question	Score	$\overline{X}$	σ	Correct rate	$\overline{X}$	σ	Correct rate
PK	16	Q7	2	1.38	0.92	69.1%	10.15	2.64	63.4%
		Q8	2	1.82	0.57	90.9%			
		Q9	2	1.31	0.95	65.5%			
		Q10	2	0.51	0.87	25.5%			
		Q11	2	1.78	0.62	89.1%			
		Q12	2	1.45	0.89	72.7%			
		Q34	4	1.89	2.00	47.3%			

Judging from the scores of each question in the PK dimension, the scoring rates for Q8 and Q11 are relatively high, at 90.9%, and 89.1%, respectively. However, the scoring rates for Q10 and Q34 are lower, at 25.5% and 47.3%, respectively. Teacher internship students' $\overline{X}$ score in the PK dimension is 10.15 points, **σ** is 2.64, and the dimension score rate is 63.4%.

Table 4.24 The average scores and standard deviations of the TPACK post-test in the CK dimension for primary school teacher internship students

Dimensions	Score	Question	Score	$\overline{X}$	σ	Correct rate	$\overline{X}$	σ	Correct rate
CK	15	Q13	3	1.36	1.49	45.5%	8.93	2.46	59.5%
		Q14	3	1.53	1.50	50.9%			
		Q15	3	1.20	1.47	40.0%			
		Q16	2	1.56	0.83	78.2%			
		Q35	4	3.27	1.54	81.8%			

Judging from the scores of each question in the CK dimension, the scoring rates for Q16 and Q35 are nearly 80%, at 78.2% and 81.8%, respectively. However, the scoring rates for Q13 and Q15 are relatively low, at only 45.5% and 40.0%. Teacher internship students' $\overline{X}$ score in the CK dimension is 8.93 points, **σ** is 2.46, and the dimension score rate is 59.5%.

Table 4.25 The average scores and standard deviations of the TPACK post-test in the TPK dimension for primary school teacher internship students

Dimensions	Score	Question	Score	$\overline{X}$	σ	Correct rate	$\overline{X}$	σ	Correct rate
TPK	14	Q17	2	1.42	0.91	70.9%	7.02	3.12	50.1%
		Q18	2	0.84	0.99	41.8%			
		Q19	2	1.89	0.45	94.5%			
		Q20	2	0.98	1.00	49.1%			
		Q21	2	0.87	0.99	43.6%			
		Q36	4	1.02	1.74	25.5%			

Judging from the scores of each question in the TPK dimension, the scoring rates for Q19 is relatively high, at 94.5%, respectively. However, the scoring rates for Q18, Q20, Q21, and Q36 are lower, at 41.8%, 49.1%, 43.6% and 25.5%, respectively. Teacher internship students' $\overline{X}$ score in the TPK dimension is 7.02 points, **σ** is 3.12, and the dimension score rate is 50.1%.

Table 4.26 The average scores and standard deviations of the TPACK post-test in the TCK dimension for primary school teacher internship students

Dimensions	Score	Question	Score	$\overline{X}$	σ	Correct rate	$\overline{X}$	σ	Correct rate
TCK	14	Q22	2	1.38	0.92	69.1%	10.18	1.72	72.7%
		Q23	2	1.16	0.99	58.2%			
		Q24	2	1.45	0.89	72.7%			
		Q25	2	1.09	1.00	54.5%			
		Q26	2	1.16	0.99	58.2%			
		Q37	4	3.93	0.53	98.2%			

Judging from the scores of each question in the TCK dimension, the scoring rates for Q37 is the highest, at 98.2%, while the scoring rates for Q23, Q25 and Q26 are the lowest, at 58.2%, 54.5% and 58.2%. Teacher internship students' $\overline{X}$ score in the TCK dimension is 10.18 points, **σ** is 1.72, and the dimension score rate is 72.7%.

Table 4.27 The average scores and standard deviations of the TPACK post-test in the PCK dimension for primary school teacher internship students

Dimensions	Score	Question	Score	$\overline{X}$	σ	Correct rate	$\overline{X}$	σ	Correct rate
PCK	16	Q27	3	1.33	1.49	44.4%	9.18	2.30	57.4%
		Q28	3	0.93	1.39	30.9%			
		Q29	3	2.45	1.16	81.8%			
		Q30	3	2.24	1.31	74.5%			
		Q38	4	2.25	1.98	56.4%			

Judging from the scores of each question in the PCK dimension, the scoring rate for Q29 is the highest, at 81.8%, while the scoring rate for Q28 is the lowest, at 30.9%.Teacher internship students' $\overline{X}$ score in the PCK dimension is 9.18 points, **σ** is 2.30, and the dimension score rate is 57.4%.

Table 4.28 The average scores and standard deviations of the TPACK post-test in the TPCK dimension for primary school teacher internship students

Dimensions	Score	Question	Score	$\overline{X}$	σ	Correct rate	$\overline{X}$	σ	Correct rate
TPCK	8	Q31	2	1.71	0.71	85.5%	5.09	2.05	63.6%
		Q32	2	0.55	0.89	27.3%			
		Q39	4	2.84	1.82	70.9%			

Judging from the scores of each question in the TPCK dimension, Q31 is the highest score rate, which is 85.5%; Q32 is the lowest score rate, which is 27.3%. Teacher internship students' $\overline{X}$ score in the TPCK dimension is 5.09 points, **σ** is 2.05, and the dimension score rate is 63.6%.

Table 4.29 The comparison between the pre-test and post-test results of TPACK for primary school teacher internship students

Dimension	Full score	Highest score		Lowest score		σ		Correct rate	
		Pre-	Post-	Pre-	Post-	Pre-	Post-	Pre-	Post-
Whole	100	66	94	32	39	8.08	11.68	48.3%	60.4%
TK	17	11	17	0	3	2.44	3.55	30.5%	58.1%
PK	16	14	16	2	4	2.88	2.64	59.3%	63.4%
CK	15	15	15	3	5	3.29	2.46	55.4%	59.5%
TPK	14	12	14	2	2	2.07	3.12	43.1%	50.1%
TCK	14	14	12	4	6	2.89	1.72	61.0%	72.7%
PCK	16	13	16	0	6	2.53	2.30	46.0%	57.4%
TPCK	8	6	8	0	2	1.58	2.05	41.8%	63.6%

Note: Pre- refers to Pre-test; Post- refers to Post-test.

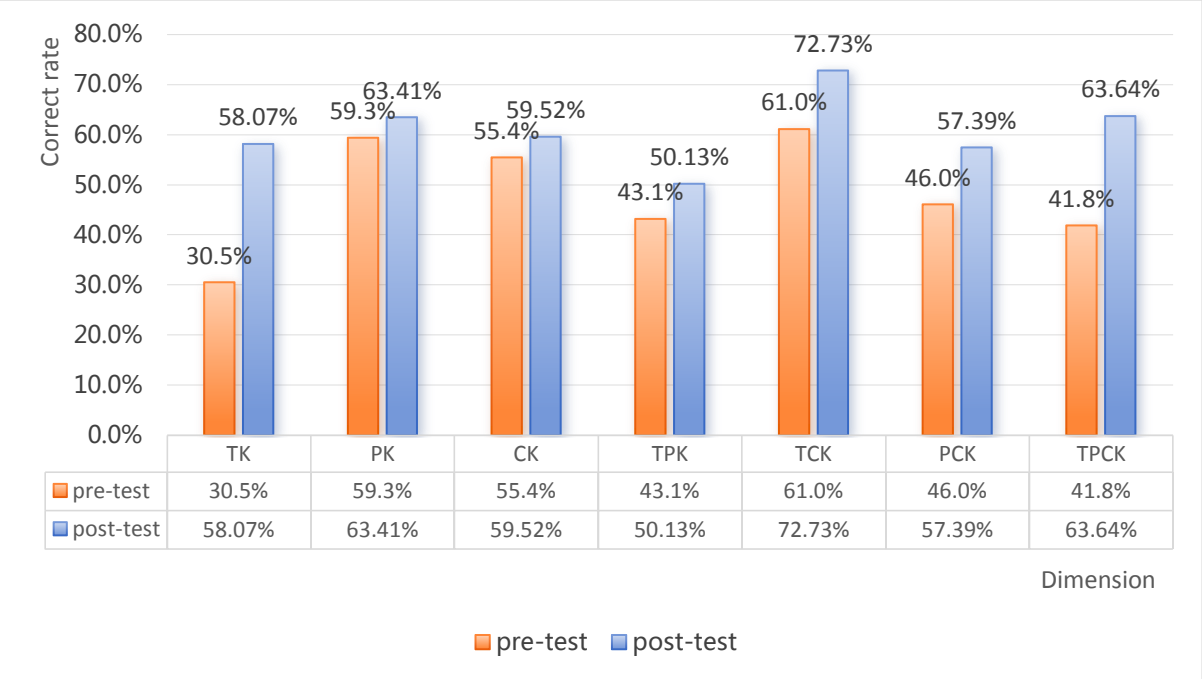


Figure 4.5 Comparison of the average percentage correct on each dimension of the TPACK pre-test and post-test

Comparing the data between pre-test and post-test, the post-test scores were significantly higher than the pre-test scores. The highest score of TPACK increased from 66 points to 94 points, the lowest score increased from 32 points to 39 points, and the accuracy rate increased from 48.3% to 60.4%, the scores in each dimension have improved to varying degrees, which also shows that the training is effective to a certain extent.

Table 4.30 The comparison of TPACK pre-test and post-test ratings across various dimensions for primary school teacher internship students

Grade	Whole		TK		PK		CK		TPK		TCK		PCK		TPCK	
	Pre-	Post-	Pre-	Post-	Pre-	Post-	Pre-	Post-	Pre-	Post-	Pre-	Post-	Pre-	Post-	Pre-	Post-
Excellent	0	4	0	7	4	9	6	4	1	6	11	21	0	2	0	8
Good	0	5	1	20	16	8	12	9	4	6	14	20	3	7	6	27
Average	5	14	4	8	14	18	15	26	9	10	13	12	15	28	0	0
Passable	20	26	10	12	10	16	10	14	25	20	9	2	20	15	30	8
Poor	30	6	40	8	11	4	12	2	16	13	8	0	17	3	19	12

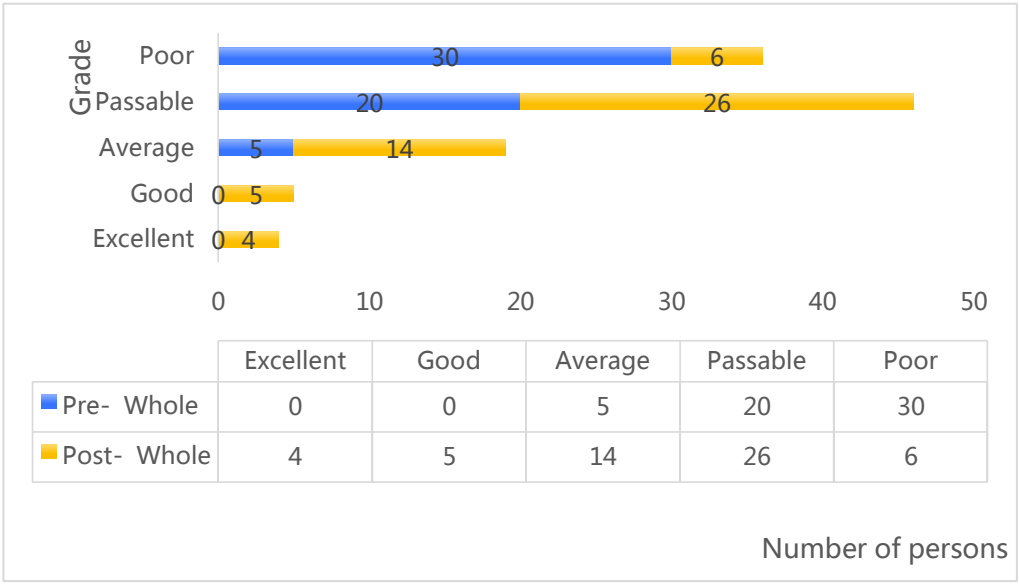
Note: Pre- refers to Pre-test; Post- refers to Post-test.

As shown in the above table, there are significant changes in the number of students at different levels in each dimension of TPACK for primary school teacher internship students. The most notable changes include: In the TK, PCK and TPCK dimensions, the number of students with an excellent rating increased from 0 in the pre-test to 7, 2 and 8 in the post-test, respectively. In the PK dimension, it increased from 4 to 9; In the TPK dimension, it increased from 1 to 6; In the TCK dimension, it increased from 11 to 21; but in the CK dimension, it decreased from 6 to 4;

The number of students with a Good rating also showed positive changes: In the TK dimension, the number increased from 1 in the pre-test to 20 in the post-test; In the TPCK dimension, it increased from 6 to 27; In the TCK dimension, it increased from 14 to 20; In the PCK dimension, it increased from 3 to 7; and in the TPK dimension, it increased from 4 to 6.

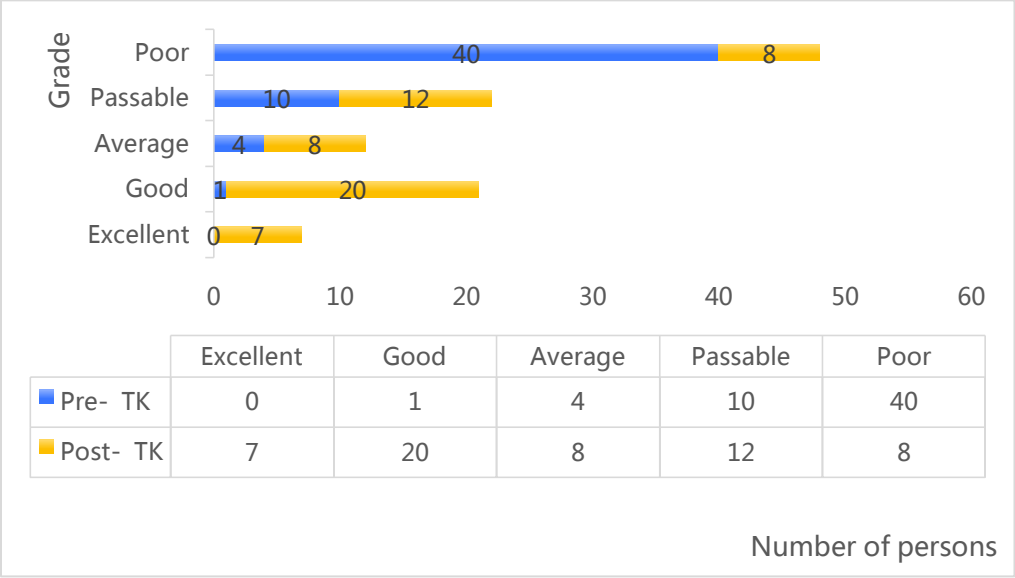
There were noticeable changes in the number of students with a Poor grade: In the TK dimension, the number decreased from 40 in the pre-test to 8 in the post-test; In the PK dimension, it decreased from 11 to 4; In the CK dimension, it

decreased from 12 to 2; In the TPK dimension, it decreased from 16 to 13; In the TCK dimension, it decreased from 8 to 0; In the PCK dimension, it decreased from 17 to 3; and in the TPCK dimension, it decreased from 19 to 12.



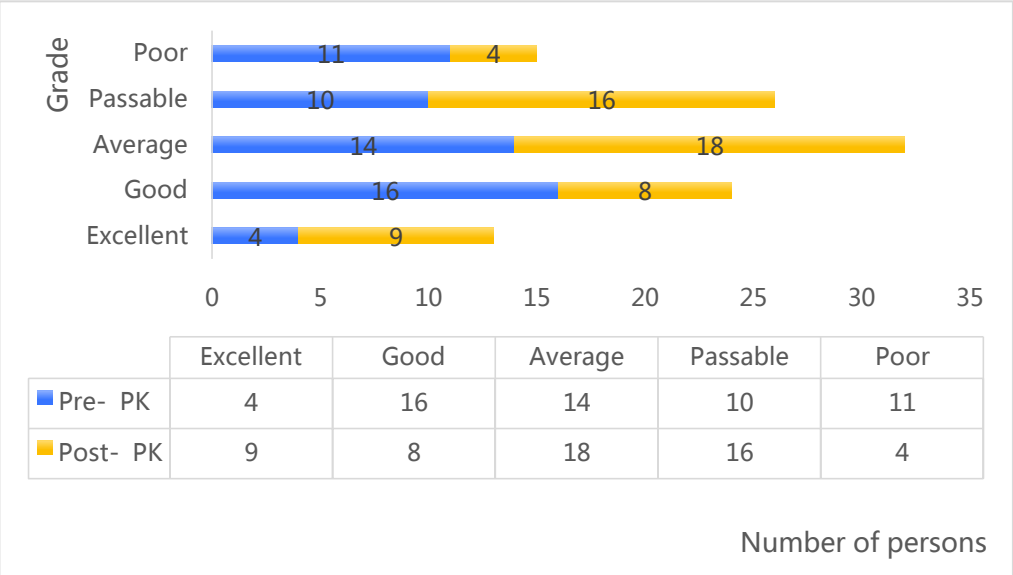
	Excellent	Good	Average	Passable	Poor
Pre- Whole	0	0	5	20	30
Post- Whole	4	5	14	26	6

Figure 4.6 The comparison of TPACK pre-test and post-test grade on Whole dimensions for primary school teacher internship students



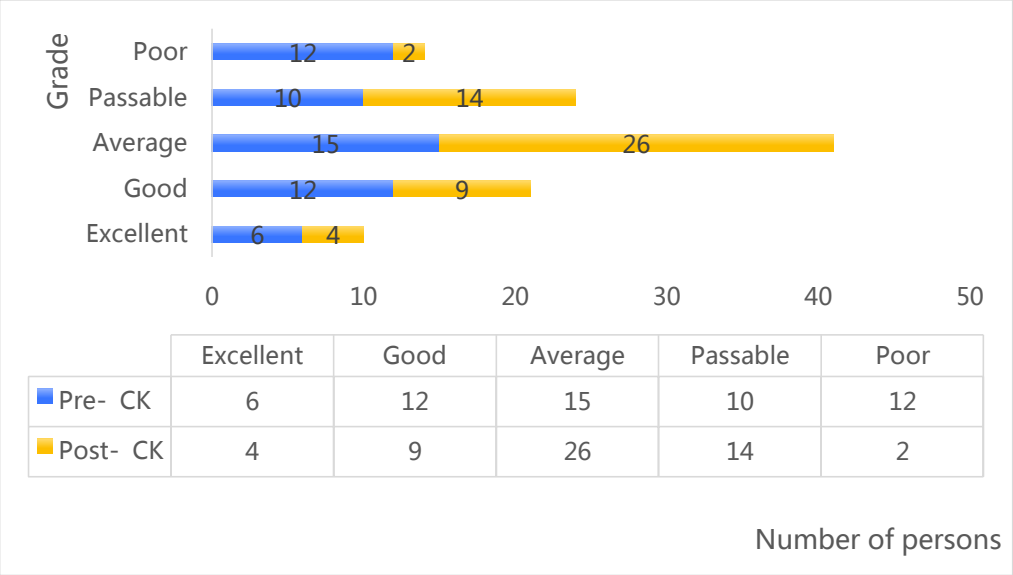
	Excellent	Good	Average	Passable	Poor
Pre- TK	0	1	4	10	40
Post- TK	7	20	8	12	8

Figure 4.7 The comparison of TPACK pre-test and post-test grade on TK dimensions for primary school teacher internship students



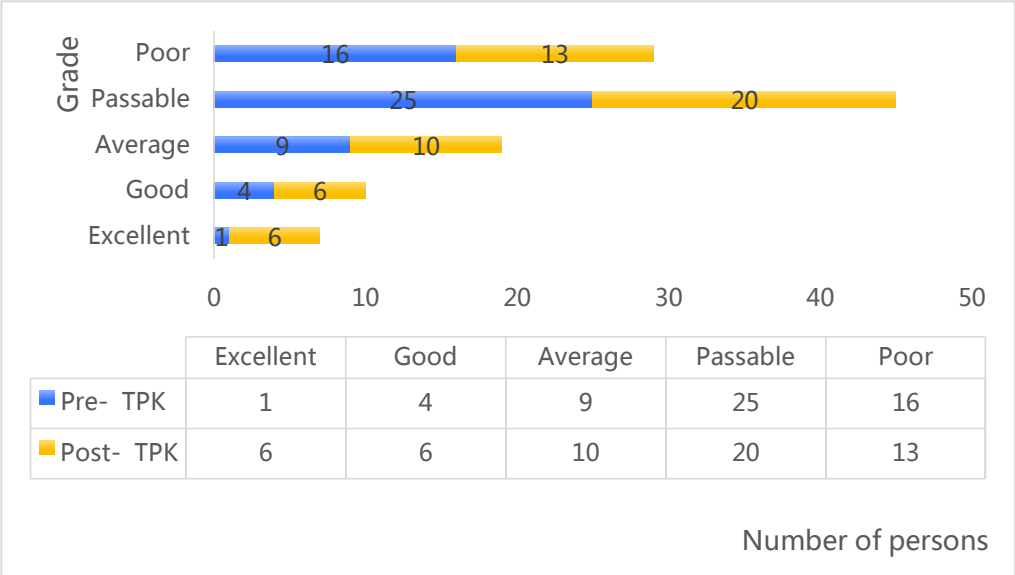
	Excellent	Good	Average	Passable	Poor
Pre- PK	4	16	14	10	11
Post- PK	9	8	18	16	4

Figure 4.8 The comparison of TPACK pre-test and post-test grade on PK dimensions for primary school teacher internship students



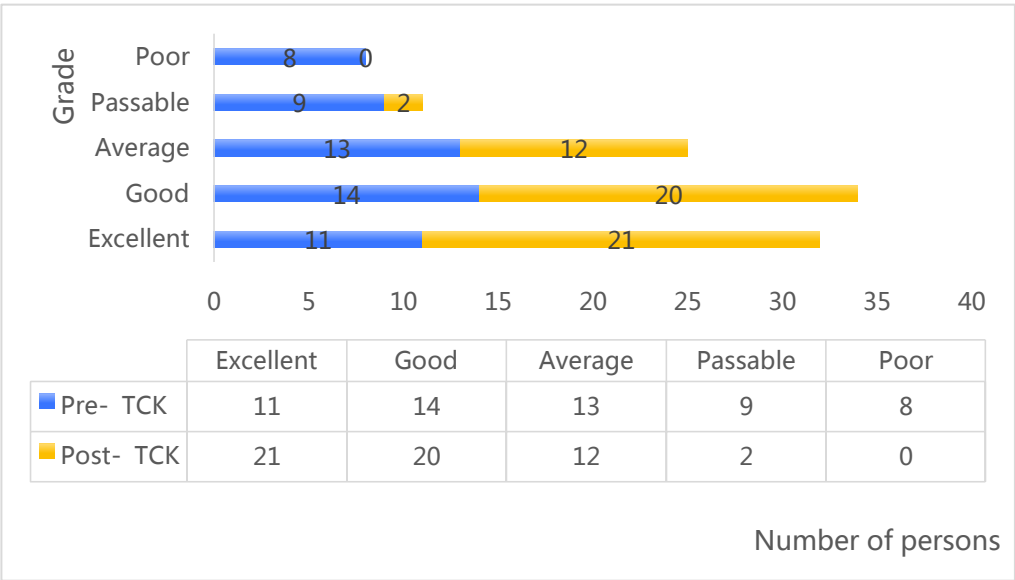
	Excellent	Good	Average	Passable	Poor
Pre- CK	6	12	15	10	12
Post- CK	4	9	26	14	2

Figure 4.9 The comparison of TPACK pre-test and post-test grade on CK dimensions for primary school teacher internship students



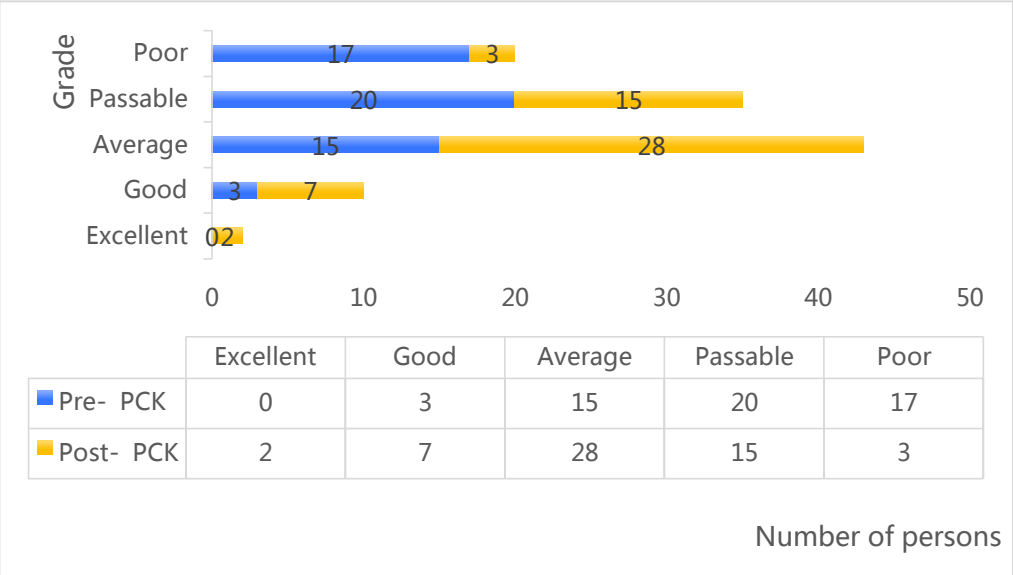
	Excellent	Good	Average	Passable	Poor
Pre- TPK	1	4	9	25	16
Post- TPK	6	6	10	20	13

Figure 4.10 The comparison of TPACK pre-test and post-test grade on TPK dimensions for primary school teacher internship students



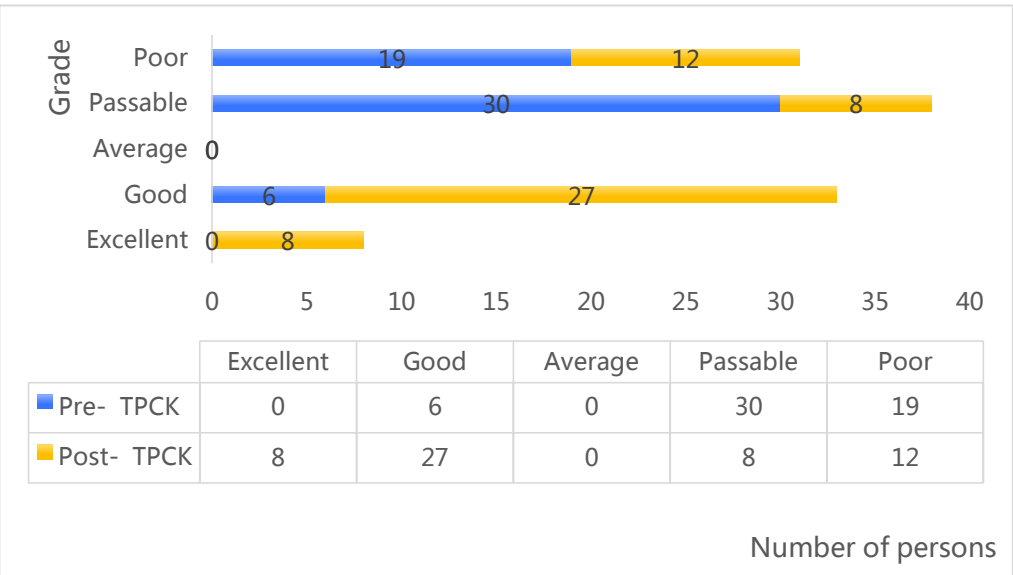
	Excellent	Good	Average	Passable	Poor
Pre- TCK	11	14	13	9	8
Post- TCK	21	20	12	2	0

Figure 4.11 The comparison of TPACK pre-test and post-test grade on TCK dimensions for primary school teacher internship students



	Excellent	Good	Average	Passable	Poor
Pre- PCK	0	3	15	20	17
Post- PCK	2	7	28	15	3

Figure 4.12 The comparison of TPACK pre-test and post-test grade on PCK dimensions for primary school teacher internship students



	Excellent	Good	Average	Passable	Poor
Pre- TPCK	0	6	0	30	19
Post- TPCK	8	27	0	8	12

Figure 4.13 The comparison of TPACK pre-test and post-test grade on TPCK dimensions for primary school teacher internship students

3. Experts assess the results of the implementation of the TPACK development strategy for primary school teacher internship students

According to the CIPP assessment model, five experts evaluated the improvement strategy for the TPACK of teacher internship students in terms of context, input, process and product. The evaluation results show that the five experts unanimously agreed on context, process and product with a rate of 100%. One expert partially agreed with the input, believes that the course training plan can be more enriched in content, more consideration should be given to the academic background of teacher internship students and the Chinese teaching requirements of primary schools at different school stages before formulating the content. Although currently teacher internship students are practicing in primary schools in urban areas, However, in the future, the vast majority of teacher internship students will serve as primary school Chinese teachers in rural areas. Therefore, the particular academic situation of primary school students in rural schools must be taken into consideration.

Table 4.31 Results of CIPP assessment on TPACK improvement strategy implementation effectiveness

No.	Dimension	Opinion of the experts					
		Agree		Partially Agree		Disagree	
		F	P	F	P	F	P
1	Context	5	100%	0	0%	0	0%
2	Input	4	80%	1	20%	0	0%
3	Process	5	100%	0	0%	0	0%
4	Product	5	100%	0	0%	0	0%

Note: F refers to Frequency; P refers to Percentage.

Chapter 5

Conclusion, Discussion and Recommendations

The aims of the present study include 3 objectives:

1. To explore the current problem of TPACK ability for teacher internship students.

2. To develop strategy of TPACK ability for teacher internship students.

3. To evaluate the improvement strategy of TPACK ability for teacher internship students.

The details are as follows.

Conclusion

1. To explore the current problem of TPACK ability for teacher internship students.

By preparing test papers and conducting a pre-test on TPACK ability of primary school teacher internship students before their educational internship, we learned that the overall TPACK ability of primary school teacher internship students is at a low level. This test result is consistent with the results of normal university students or teacher internship students mentioned in many literatures. The conclusion that TPACK is at low level is consistent. In this TPACK pre-test, the order of the average score rates of the seven dimensions from high to low is: TCK > PK > CK > PCK > TPK > TPCK > TK. From literature research, we know that TK, PK, and CK are the three basic knowledge that constitute TPACK ability, but it does not mean that the mastery of these three types of knowledge is directly proportional to the integrated knowledge TPK, TCK, PCK, and TPACK. We previously the average score rate of the seven dimensions in the test also does not show a positive correlation. This phenomenon shows that in addition to having good knowledge of the three independent factors of TK, PK, and CK, it is also necessary to further explore how to “integrate” this complex issue. Therefore, when formulating TPACK improvement strategies, in addition to targeted strategies for the three basic dimensions of TK, PK, and CK, it is also necessary to integrate theory with practice from the perspective of

teaching practice, and comprehensively integrate knowledge TPK, TCK ,PCK proposes effective strategies.

2. To develop strategy of TPACK ability for teacher internship students.

(1) Sort out and analyze the literature to comprehensively understand the influencing factors of teacher education students' TPACK. Through literature analysis, it can be seen that the TPACK ability of teacher education students is affected by demographic factors and individual factors, internal factors and external factors. Among them, among the demographic factors, the impact of gender, grade, school level, internship school type, student source type, professional identity, self-efficacy, computer proficiency, etc. on their TPACK ability was explored. Internal factors were mainly discussed. The three basic factors of TK, PK, and CK in the TPACK structural framework and the three composite factors of TPK, TCK, and PCK influence TPACK. The external factors mainly discuss the teachers of normal university students, peer teacher education students, education and training courses, learning environment, The impact of teaching reflection, internship length, etc. on TPACK ability.

(2) The research results of many studies are inconsistent. For example, in studies examining the impact of demographic factors on TPACK, some research suggests that the gender of teacher education students has no effect on TPACK (Gao, J.et al. 2022; Nie, X.Y et al. 2015), while other studies show the opposite results (Qin,C.L et al. 2022; Xing, Y. 2022). Regarding the impact of internal factors, the predictive effects of PCK , TCK, and other single-dimensional knowledge components such as TK, PK, and CK on TPACK vary or even contradict across different studies (Nie, X.Y et al. 2015; Duan, Y.M et al. 2016). The emergence of these contradictions indicates, on one hand, variations in TPACK ability among different samples in terms of demographic characteristics and various dimensions of proficiency. On the other hand, it may be related to the subjective nature inherent in the questionnaire survey method used for TPACK measurement.

(3) Combined with reality, determine the relevant factors of the TPACK improvement strategy for primary school teacher internship students. This study specifically focuses on the teacher education students in the internship stage of a certain college. Differences in student source category (the research subjects are all students from rural areas in Guangxi), grade, school grade, internship school category,

etc. can be eliminated. Considering that factors such as professional identity and self-efficacy have been throughout the entire university education stage, and special guidance and training are also provided according to the regular requirements of internships during the educational internship stage, they have not been included in the TPACK improvement strategy. TPACK is affected by six internal factors. The three basic factors of TK, PK, and CK are the prerequisite for the existence of the three composite factors of TPK, TCK, and PCK. Although the abilities of the three composite factors of TPK, TCK, and PCK are related to those of TK, PK, and CK is affected by other factors such as integration ability and may not necessarily show a positive correlation trend. However, without the three basic factors of TK, PK and CK, the three composite factors of TPK, TCK and PCK will be impossible to discuss. Among the external factors, teachers of normal university students, teacher education student's classmates, learning environment, internship length and other factors are facts that teacher internship students cannot be changed. When formulating the TPACK improvement strategy for primary school teacher internship students, we must take the premise of solving the main problems instead of covering everything. At the same time, This study is constrained by the researcher's practical limitations. The researcher is just an ordinary college teacher with the authority to provide suggestions on matters such as the duration of internships, the selection of internship schools, and the allocation of teacher internship students. However, there is no guarantee that these suggestions will be adopted. Therefore, The researcher can only develop improvement strategy based on teachers' own abilities. This study is grounded in constructivist theory, teacher reflection theory and cooperative learning theory, Specialized training sessions were conducted to enhance TK, PK, and CK. Additionally, instructional observations and reflective activities were implemented to holistically improve TPACK. Through these activities, participants learned from exemplary teachers in areas such as teaching techniques, classroom management, communication skills, personalized instruction, and curriculum handling. This approach aimed to enhance the understanding and application of the interactive relationships among technology, content, and pedagogy. The ultimate goal was to elevate the integrative knowledge of TPK, TCK and PCK, thereby improving overall teaching proficiency in practical educational contexts.

(4) Present strategy in the form of a course training program. The strategy of this study is to set up special courses during educational internship to improve the TPACK ability of primary school teacher internship students. The course is divided into two parts. The first part is to carry out training for teacher internship students that focuses on reviewing and consolidating the three basic factors of TK, PK and CK, which is close to the actual teaching scene and highly practical. The determination of these contents is in line with internationally accepted standards. The questionnaires measured by TPACK are closely related, and the training includes a large number of group discussions and learning experience sharing among peers. The second part is to observe the teaching video teaching of outstanding teachers, allowing primary school teacher internship students to understand the four “literacy and writing”, “reading and appreciation”, “expression and communication” and “combination and exploration” stipulated in the compulsory education Chinese curriculum standards (2022 edition). The six pieces of content of each learning module (pinyin, recognizing Chinese Characters and writing Chinese Characters, oral communication, comprehensive learning, reading, and writing) have an intuitive teaching experience. After watching the teaching video, teacher internship students are organized to carry out teaching reflection and analyze the teaching process of famous teachers. How to organically integrate technology and Chinese teaching to achieve high-quality teaching results.

Present the strategy in the form of a detailed course training plan. The strategy of this study is to set up special courses during educational internship to improve the TPACK ability of primary school teacher internship students. The course is divided into two parts. The first part is a practical training for teacher internship students focusing on reviewing and consolidating the three basic factors of TK, PK and CK. The determination of these contents is closely related to the internationally popular TPACK measurement questionnaire. Relatedly, the training includes a large number of group discussions and learning experience sharing among peers. The second part is to watch the instructional videos of famous teachers, so that primary school Chinese teacher internship students can have an intuitive teaching experience on the five most basic learning modules of primary school Chinese (pinyin, Recognizing Chinese Characters and Writing Chinese Characters, oral communication, comprehensive learning, reading, and writing). After watching, the teacher internship students were organized to carry out teaching reflection and analyze how famous

teaching teachers organically integrate technology and Chinese teaching in the teaching process to achieve high-quality teaching results.

(5) The TPACK improvement strategy has been recognized by experts. Before the implementation of the strategy, the researcher organized 5 experts in related fields to assess the strategy from four aspects: practicality, feasibility, appropriateness and accuracy. The 4 experts unanimously believed that the strategy was in terms of practicality, feasibility, appropriateness and accuracy are feasible. and 1 expert believed that the appropriateness and accuracy of the policy content needed to be improved.

3. To evaluate of teacher internship student improvement strategy.

(1) Curriculum training has a significant effect on improving the TPACK of primary school teacher internship students. According to the post-test scores, it can be seen that the TPACK ability of primary school teacher internship students has been significantly improved compared with the pre-test scores. The highest score of the TPACK test increased from 66 points in the pre-test to 94 points in the post-test, the lowest score increased from 32 points in the pre-test to 39 points in the post-test, and the accuracy rate increased from 48.3% in the pre-test to 60.4% in the post-test. After training, the degree of improvement varies across dimensions. The statistics of the students' TPACK pre-test and post-test scores show that the excellent grade improved from 0 on the pre-test to 4 on the post-test. Good grade improved from 0 on the pre-test to 5 on the post-test. Average grade improved from 5 in the pre-test to 14 in the post-test. Passable grade increased from 20 in the pre-test to 26 in the post-test. Poor grade decreased from 30 in the pre-test to 6 in the post-test. This shows to a certain extent that the training has a certain effect.

(2) The post-test scores showed that the dimensions improved by different amounts compared to the pre-test, with the TK and TPCK dimensions improving more, and the dimensions' correctness increasing by 27.57% and 21.84%, respectively. The PK and CK dimensions improved less, and the dimensions' correctness increasing by between 4%-6%.

(3) The CIPP evaluation results confirm the implementation effect of the strategy. According to the expert CIPP evaluation results, the five experts believed that this improvement strategy is effective in improving the TPACK ability of primary school teacher internship students.

Discussion

1. To explore the current problem of TPACK ability for teacher internship student.

(1) The average ability of primary school teacher internship students TPACK in the seven dimensions is at a “poor” level, and the abilities in each dimension are not high. This research result is consistent with the research results of TPACK measurement of normal university students in previous literature.

(2) From the three basic dimensions, the PK dimension has the highest score, the CK dimension has a lower score, and the TK dimension has the lowest score. This has something to do with the characteristics of primary education majors. The primary school education major is affiliated to the School of Educational Sciences. For the School of Educational Sciences, the faculty allocation of courses related to education has obvious advantages. The educational and teaching environment and professional atmosphere created by the college play a good role in nurturing teacher education students. Therefore, primary school teacher internship students have the best knowledge of teaching methods. On the contrary, the knowledge of teacher internship students in Chinese subjects is relatively weak, and most students do not pay enough attention to basic Chinese knowledge, especially basic knowledge such as pinyin, stroke order, and modern Chinese in primary school Chinese. Since teacher internship students use pinyin more frequently, The low performance of the basic knowledge of Chinese in primary schools, as well as the influence of the writing habits that the teacher internship students have developed for a long time in stroke order writing, result in their unsatisfactory performance in the basic knowledge of Chinese in primary schools. In the following educational internship, there is an urgent need to review and consolidate the basic knowledge of Chinese subjects. The reason for the low score in the TK dimension is not only related to the fact that the teacher internship students did not offer relevant courses during college, but also related to the teacher internship students themselves not paying enough attention to Chinese APPs. The only information technology-related courses in college include modern educational technology, which is basic and universal technical content regardless of subject direction and does not involve knowledge such as primary school Chinese APP. Many students think that the information technology used in Chinese classes is the operation of electronic

whiteboards, PPT production and the acquisition of network information resources. They are not familiar with the operation of Chinese APPs. In fact, such APPs have highly targeted learning content and embodying design concepts. Teaching is fun, and the exploratory and inspiring challenge mode is deeply loved by primary school students. It can help primary school Chinese teachers carry out teaching better and is also a reflection of the TPACK ability of teacher internship students.

(3) Judging from the results of this study, the results produced by using self-made test papers as a research tool are basically consistent with many domestic research results using questionnaire surveys. This also shows the validity and reliability of the test paper as a research tool. Currently, the most commonly used methods for measuring TPACK at home and abroad are divided into two categories: quantitative measurement and qualitative measurement. Since scale testing methods are highly subjective, qualitative measurement methods such as performance evaluation methods have problems such as complex operations, time-consuming and labor-intensive operations, which affect the measurement results of TPACK to a certain extent. The test paper developed in this study takes specific knowledge content as the assessment object, and scores the test based on the answers of normal university students to the knowledge of each single dimension and integrated dimension of TPACK. It is a relatively objective TPACK measurement method, which effectively reduces the scale type. The subjectivity error of the self-reported TPACK ability test, and compared with the performance evaluation method, classroom observation method and interview method, the test paper test method will be more time-saving and labor-saving, and is a research tool worth learning from.

2. To develop strategy of TPACK ability for teacher internship student.

(1) This study developed a detailed TPACK ability improvement course for primary school Chinese teachers. Previous literature can recognize that the course offerings of normal university students during their schooling will affect their TPACK ability. It is recommended that universities adjust course offerings and ensure the sequence of course offerings, but does not elaborate on the content of the courses. And most of the previous studies focused on the adjustment of theoretical courses and practical courses for teacher education students during their university studies. Few researchers have paid attention to the fact that improving TPACK during educational internships can be achieved by setting up online courses. In addition to

the practical teaching guidance provided by the intern instructors and intern team teachers during the day, the knowledge involved in the three basic factors TK, PK, and CK of TPACK is reviewed and consolidated in the form of courses in the evening, observing teaching videos of outstanding teachers and conducting teaching reflections in the form of group discussions can accelerate the improvement of TPACK ability of teacher education students during education internships.

(2) This study developed a reasonable TPACK improvement strategy for primary school teacher internship students. Starting from the characteristics of educational internships, the researchers trained primary school teacher internship students through online courses. A training course of 80 minutes is scheduled each evening for each working day after the teacher internship students enter the trainee school. The course is conducted in the form of a combination of lecture and practice, emphasizing the practical operation and training of the teacher internship students. When teacher internship students begin to enter the teaching practice stage, according to the six basic modules of elementary school Chinese, pinyin, literacy and writing, reading, writing, oral communication, and comprehensive learning, the teacher internship students are organized to observe the teaching videos of the six modules of the master teachers of elementary school Chinese teaching for one time each, and carry out teaching reflection after each viewing of the teaching videos, so that they can reflect on their own deficiencies in teaching in comparison with the teaching strengths of the master teachers and gain more confidence in their own teaching through peer exchange, curriculum training teacher guidance, to obtain more knowledge. This kind of training is in line with the reality and the training content is highly targeted. It did not overburden the teacher internship students, nor did it detach from the actual teaching of Chinese in elementary school and add extra content.

3. To evaluate the improvement strategy of TPACK ability for teacher internship students.

(1) Judging from the TPACK post-test results, the evaluation of intern instructors and the CIPP assessment results, teacher internship students have improved their abilities to varying degrees, which to a certain extent shows the effectiveness of the strategy. However, researchers believe that there should be more evaluation methods to improve TPACK ability, such as conducting teaching

competitions for teacher internship students, open classes for teacher internship students, primary school students' evaluation of the teaching quality of teacher internship students, etc., from more aspects. Understand whether the TPACK ability of teacher internship students has been improved.

(2) Judging from the results of previous literature research, the educational internship stage itself is an important period for the rapid improvement of teacher internship students' TPACK ability. Teacher internship students can learn a lot of knowledge from daily lectures and their own teaching practices, which is essential for improving their information-based teaching. Therefore, in order to investigate the magnitude of the effect of educational internship on the improvement of teacher internship students' TPACK ability, this research conducted a small-scale test on teacher internship students simultaneously in another primary school where this internship took place, and from the results of the test, it was found that the effect of educational internship on teacher internship students' TPACK was not significant. There may be two reasons for this: On the one hand, the duration of the internship was only eight weeks, it takes one or two more weeks for the teacher internship students to enter the internship primary school and adapt to the environment. As a result, the short educational internship did not contribute to the enhancement of their TPACK ability. On the other hand, the study participants and other trainee teachers were interned in rural primary schools, and the primary schools supervisors themselves generally had low TPACK ability and could not guide the teacher internship students well. Therefore, to what extent the development and implementation of the training course affected the improvement of TPACK ability, future research needs to create appropriate questionnaires, conduct questionnaire surveys, and conduct higher-level data analyses such as regression analyses of the survey results to prove the impact of the course training on teacher internship students' TPACK.

Recommendations

Implications

The results of this study are applicable to other similar institutions of higher learning and will play a role in improving the TPACK ability of primary school teacher internship students. At the same time, it can also serve as a reference for educational internships in other disciplines. Other disciplines can learn from the strategy formulation method and design a TPACK improvement strategy suitable for this discipline. For example, the TPACK ability improvement strategy for primary school Mathematics teacher internship students involves exploring the unique knowledge contained in TK, PK, and CK in primary school Mathematics, searching for instructional videos of famous teachers in several major types of primary school mathematics teaching, and conducting learning and teaching reflections. Similarly, It will be helpful to improve the TPACK ability of primary school mathematics teacher internship students.

It should be noted that students in the internship stage are in a very busy state and each internship supervisor has different tasks assigned to them, resulting in different amounts of free time. As a result, they have very little time to concentrate on their studies during their internships, posing a formidable challenge to the implementation of this program. If colleges and universities conduct a one-week intensive training program with the TPACK improvement strategy in this study as the training content before, rather than the internships begin, there will be a better enhancement effect on the teacher internship students' TPACK ability.

Future Researches

(1) In future research, we will try to use larger samples, conduct regression analysis, and structural equation modeling to verify the effectiveness of the strategy to establish more reliable research evidence.

(2) To enrich the content of the TPACK training courses for teacher internship students and explore the impact of different training methods on the TPACK level of teacher internship students.

(3) Research the special requirements of TPACK in different subject areas in primary schools in order to provide specific TPACK improvement strategies for educators in various subject areas of primary education majors.

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Appendices

Appendix A

List of Specialists and Letters of Specialists Invitation

for IOC Verification

List of experts to validate research instruments (Assessment expert information)

No.	Prof. Name	Work unit	Position	what to invite them to do
1	Associate Professor. Mo Junmiao	Guangxi Science and Technology Normal University	Vice dean in charge of teaching, School of educational sciences	1. Assess test papers and score rubrics 2. Assess the feasibility of an improvement strategy before executing it
2	Associate Professor. Huang Chao	Guangxi Science and Technology Normal University	1. Member of the school-level teaching supervision team 2. Primary school education major Chinese teacher	
3	Associate Professor. Lan Qiuyan	Guangxi Science and Technology Normal University	Primary school education major Chinese teacher	
4	Associate Professor. Lan Fang	Guangxi Science and Technology Normal University	Head of the liberal arts teaching and research section of primary education major Chinese teacher	
5	Associate Professor. Li Xiaoling	Guangxi Science and Technology Normal University	Primary school education major Chinese teacher	

List of experts to validate research instruments (Assessment expert information, Continued)

No.	Prof. Name	Work unit	Position	what to invite them to do
6	Professor. Yang DaoLin	Central China Normal University	Doctoral advisor in Chinese education major	Conduct CIPP assessment on the improvement of teacher internship students' TPACK
7	Professor. Liu Tiequn	Guangxi Normal University	Doctoral advisor of modern and contemporary Chinese literature	
8	Professor. Fu Xianquan	Liuzhou Vocational & Technical college	Deputy director of academic affairs Office	
9	Associate Professor. He Jian	Guangxi Normal University	Master's advisor Faculty ofeducation teacher	
10	Associate Professor. Li Dan	Nanning Normal University	Teacher at the Chinese teaching and research section, college of elementary education	

Appendix B

Official Letter

Ref.No. MHESI 0643.14/1935

Bansomdejchaopraya Rajabhat University
1061 Itsaraparb Hirunrujee
Thonburi Bangkok 10600
November 2023

Subject: Request for Evaluation of Research Instrument
Dear Associate Professor Mo Junmiao

Regarding the thesis entitled "Development of Teacher Internship Student Improvement Strategy On TPACK Teaching Practices" by Miss Fang Fang, a Ph.D. student majoring in Digital Technology Management for Education Program at Bansomdejchaopraya Rajabhat University, Thailand under the supervision of Dr.Nainapas Injoungjirakit as major advisor and Assoc. Prof. Dr.Sombat Teekasup as co-advisor, the researcher would like your expertise to evaluate the research instruments. Knowing your experience in the relevant field, I would like to ask for your help in evaluating the attached research instruments. Your recommendations would be useful for further improvement of this research instrument.

I will gladly hear your suggestions and comments for the attached research instruments. Your positive response is highly appreciated.

Sincerely,

(Assistant Professor Dr.Kanakorn Sawangcharoen)
Dean of Graduate School

Bansomdejchaopraya Rajabhat University
Tel.+662-473-7000
https://grad.bsru.ac.th
E-mail: academic.grad@bsru.ac.th

Ref.No. MHESI 0643.14/ 1936

Bansomdejchaopraya Rajabhat University
1061 Itsaraparb Hirunrujee
Thonburi Bangkok 10600
November 2023

Subject: Request for Evaluation of Research Instrument
Dear Associate Professor.Huang Chao

Regarding the thesis entitled "Development of Teacher Internship Student Improvement Strategy On TPACK Teaching Practices" by Miss Fang Fang, a Ph.D. student majoring in Digital Technology Management for Education Program at Bansomdejchaopraya Rajabhat University, Thailand under the supervision of Dr.Nainapas Injoungjirakit as major advisor and Assoc. Prof. Dr.Sombat Teekasup as co-advisor, the researcher would like your expertise to evaluate the research instruments. Knowing your experience in the relevant field, I would like to ask for your help in evaluating the attached research instruments. Your recommendations would be useful for further improvement of this research instrument.

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Ref.No. MHESI 0643.14/ 1987

Bansomdejchaopraya Rajabhat University
1061 Itsaraparb Hirunrujee
Thonburi Bangkok 10600
November 2023

Subject: Request for Evaluation of Research Instrument
Dear Associate Professor.Lan Qiuyan

Regarding the thesis entitled "Development of Teacher Internship Student Improvement Strategy On TPACK Teaching Practices" by Miss Fang Fang, a Ph.D. student majoring in Digital Technology Management for Education Program at Bansomdejchaopraya Rajabhat University, Thailand under the supervision of Dr.Nainapas Injoungjirakit as major advisor and Assoc. Prof. Dr.Sombat Teekasup as co-advisor, the researcher would like your expertise to evaluate the research instruments. Knowing your experience in the relevant field, I would like to ask for your help in evaluating the attached research instruments. Your recommendations would be useful for further improvement of this research instrument.

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Ref.No. MHESI 0643.14/1938

Bansomdejchaopraya Rajabhat University
1061 Itsaraparb Hirunrujee
Thonburi Bangkok 10600
November 2023

Subject: Request for Evaluation of Research Instrument
Dear Associate Professor.Lan Fang

Regarding the thesis entitled "Development of Teacher Internship Student Improvement Strategy On TPACK Teaching Practices" by Miss Fang Fang, a Ph.D. student majoring in Digital Technology Management for Education Program at Bansomdejchaopraya Rajabhat University, Thailand under the supervision of Dr.Nainapas Injoungjirakit as major advisor and Assoc. Prof. Dr.Sombat Teekasup as co-advisor, the researcher would like your expertise to evaluate the research instruments. Knowing your experience in the relevant field, I would like to ask for your help in evaluating the attached research instruments. Your recommendations would be useful for further improvement of this research instrument.

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Ref.No. MHESI 0643.14/ 1930

Bansomdejchaopraya Rajabhat University
1061 Itsaraparb Hirunrujee
Thonburi Bangkok 10600
November 2023

Subject: Request for Evaluation of Research Instrument
Dear Associate Professor.Li Xiaoling

Regarding the thesis entitled "Development of Teacher Internship Student Improvement Strategy On TPACK Teaching Practices" by Miss Fang Fang, a Ph.D. student majoring in Digital Technology Management for Education Program at Bansomdejchaopraya Rajabhat University, Thailand under the supervision of Dr.Nainapas Injoungjirakit as major advisor and Assoc. Prof. Dr.Sombat Teekasup as co-advisor, the researcher would like your expertise to evaluate the research instruments. Knowing your experience in the relevant field, I would like to ask for your help in evaluating the attached research instruments. Your recommendations would be useful for further improvement of this research instrument.

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Ref.No. MHESI 0643.14/ 1930

Bansomdejchaopraya Rajabhat University
1061 Itsaraparb Hirunrujee
Thonburi Bangkok 10600
November 2023

Subject: Request for Evaluation of Research Instrument
Dear Professor.Yang DaoLin

Regarding the thesis entitled "Development of Teacher Internship Student Improvement Strategy On TPACK Teaching Practices" by Miss Fang Fang, a Ph.D. student majoring in Digital Technology Management for Education Program at Bansomdejchaopraya Rajabhat University, Thailand under the supervision of Dr.Nainapas Injoungjirakit as major advisor and Assoc. Prof. Dr.Sombat Teekasup as co-advisor, the researcher would like your expertise to evaluate the research instruments. Knowing your experience in the relevant field, I would like to ask for your help in evaluating the attached research instruments. Your recommendations would be useful for further improvement of this research instrument.

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Ref.No. MHESI 0643.14/ 1941

Bansomdejchaopraya Rajabhat University
1061 Itsaraparb Hirunrujee
Thonburi Bangkok 10600
November 2023

Subject: Request for Evaluation of Research Instrument
Dear Professor.Liu Tiequn

Regarding the thesis entitled "Development of Teacher Internship Student Improvement Strategy On TPACK Teaching Practices" by Miss Fang Fang, a Ph.D. student majoring in Digital Technology Management for Education Program at Bansomdejchaopraya Rajabhat University, Thailand under the supervision of Dr.Nainapas Injoungjirakit as major advisor and Assoc. Prof. Dr.Sombat Teekasup as co-advisor, the researcher would like your expertise to evaluate the research instruments. Knowing your experience in the relevant field, I would like to ask for your help in evaluating the attached research instruments. Your recommendations would be useful for further improvement of this research instrument.

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Ref.No. MHESI 0643.14/ 1942

Bansomdejchaopraya Rajabhat University
1061 Itsaraparb Hirunrujee
Thonburi Bangkok 10600
November 2023

Subject: Request for Evaluation of Research Instrument
Dear Professor.Fu Xianquan

Regarding the thesis entitled "Development of Teacher Internship Student Improvement Strategy On TPACK Teaching Practices" by Miss Fang Fang, a Ph.D. student majoring in Digital Technology Management for Education Program at Bansomdejchaopraya Rajabhat University, Thailand under the supervision of Dr.Nainapas Injoungjirakit as major advisor and Assoc. Prof. Dr.Sombat Teekasup as co-advisor, the researcher would like your expertise to evaluate the research instruments. Knowing your experience in the relevant field, I would like to ask for your help in evaluating the attached research instruments. Your recommendations would be useful for further improvement of this research instrument.

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Ref.No. MHESI 0643.14/ 1943

Bansomdejchaopraya Rajabhat University
1061 Itsaraparb Hirunrujee
Thonburi Bangkok 10600
November 2023

Subject: Request for Evaluation of Research Instrument
Dear Associate Professor.Li Dan

Regarding the thesis entitled "Development of Teacher Internship Student Improvement Strategy On TPACK Teaching Practices" by Miss Fang Fang, a Ph.D. student majoring in Digital Technology Management for Education Program at Bansomdejchaopraya Rajabhat University, Thailand under the supervision of Dr.Nainapas Injoungjirakit as major advisor and Assoc. Prof. Dr.Sombat Teekasup as co-advisor, the researcher would like your expertise to evaluate the research instruments. Knowing your experience in the relevant field, I would like to ask for your help in evaluating the attached research instruments. Your recommendations would be useful for further improvement of this research instrument.

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Ref.No. MHESI 0643.14/ 1944

Bansomdejchaopraya Rajabhat University
1061 Itsaraparb Hirunrujee
Thonburi Bangkok 10600
November 2023

Subject: Request for Evaluation of Research Instrument
Dear Associate Professor.He Jian

Regarding the thesis entitled "Development of Teacher Internship Student Improvement Strategy On TPACK Teaching Practices" by Miss Fang Fang, a Ph.D. student majoring in Digital Technology Management for Education Program at Bansomdejchaopraya Rajabhat University, Thailand under the supervision of Dr.Nainapas Injoungjirakit as major advisor and Assoc. Prof. Dr.Sombat Teekasup as co-advisor, the researcher would like your expertise to evaluate the research instruments. Knowing your experience in the relevant field, I would like to ask for your help in evaluating the attached research instruments. Your recommendations would be useful for further improvement of this research instrument.

I will gladly hear your suggestions and comments for the attached research instruments. Your positive response is highly appreciated.

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Appendix C

Results of validity verification

Expert Assessment form 1

Question quality requirements		Expert assessment results		
1	The test questions are consistent with what you studied in college	Agree ☐	Partially Agree ☐	Disagree☐
2	Test question difficulty	Agree ☐	Partially Agree ☐	Disagree☐
3	Test question coverage requirements	Agree ☐	Partially Agree ☐	Disagree☐
4	Test question structure and score distribution requirements	Agree ☐	Partially Agree ☐	Disagree☐
5	Test question volume requirements	Agree ☐	Partially Agree ☐	Disagree☐
6	Repetition rate,question volume, and difficulty requirements for the two test papers	Agree ☐	Partially Agree ☐	Disagree☐
7	The test paper's scoring standards are scientific and feasible	Agree ☐	Partially Agree ☐	Disagree☐
8	The test paper has no errors	Agree ☐	Partially Agree ☐	Disagree☐
Expert assessment results	1.The validity of the test paper meets the requirements☐ 2.The validity of the test paper basically meets the requirements☐ 3.The validity of the test paper does not meet the requirements☐			
Expert assessment advice	Date: / /			

Table Appendix 1: Assessment results of TPACK test papers

No.	Item	Expert' rating					Total	Percentage	Results
		Expert 1	Expert 2	Expert 3	Expert 4	Expert 5			
1	The test questions are consistent with what you studied in college	Agree	Agree	Agree	Agree	Agree	5	100%	Valid
2	Test question difficulty	Agree	Agree	Agree	Agree	Agree	5	100%	Valid
3	Test question coverage requirements	Agree	Agree	Agree	Agree	Agree	5	100%	Valid
4	Test question structure and score distribution requirements	Agree	Partially Agree	Agree	Agree	Agree	4	80%	Valid
5	Test question volume requirements	Agree	Agree	Agree	Agree	Agree	5	100%	Valid
6	Repetition rate, question volume, and difficulty requirements for the two test papers	Agree	Agree	Agree	Agree	Agree	5	100%	Valid
7	The test paper's scoring standards are scientific and feasible	Agree	Agree	Agree	Agree	Agree	5	100%	Valid
8	The test paper has no errors	Agree	Agree	Agree	Agree	Agree	5	100%	Valid

Expert Assessment Form 2

Whole and Dimension-specific Grading Criteria		Expert Assessment Results		
Whole (100)	Excellent: 80-100, Good: 70-79, Average: 60-69, Passable: 50-59, Poor: Below 50	Agree ☐	Partially Agree ☐	Disagree☐
TK (17)	Excellent: 14-17, Good: 11-13, Average: 9-10, Passable: 7-8, Poor: Below 7	Agree ☐	Partially Agree ☐	Disagree☐
PK (16)	Excellent: 14-16, Good: 11-13, Average: 9-10, Passable: 7-8, Poor: Below 7	Agree ☐	Partially Agree ☐	Disagree☐
CK (15)	Excellent: 13-15, Good: 10-12, Average: 8-9, Passable: 6-7, Poor: Below 6	Agree ☐	Partially Agree ☐	Disagree☐
TPK (14)	Excellent: 12-14, Good: 10-11, Average: 8-9, Passable: 6-7, Poor: Below 6	Agree ☐	Partially Agree ☐	Disagree☐
TCK (14)	Excellent: 12-14, Good: 10-11, Average: 8-9, Passable: 6-7, Poor: Below 6	Agree ☐	Partially Agree ☐	Disagree☐
PCK (16)	Excellent: 14-16, Good: 11-13, Average: 9-10, Passable: 7-8, Poor: Below 7	Agree ☐	Partially Agree ☐	Disagree☐
TPACK (8)	Excellent: 7-8, Good: 6, Average:5, Passable: 4, Poor: Below 4	Agree ☐	Partially Agree ☐	Disagree☐
Expert Assessment Results	1.The objectivity of the grading criteria meets the requirements☐ 2.The objectivity of the grading criteria is generally in line with the requirements☐ 3.The objectivity of the grading criteria does not meet the requirements☐			
Expert Assessment Recommendations	Signature: Date: / /			

Table Appendix 2: Assessment results of TPACK whole and dimension-specific grading criteria

No.	Item	Expert' rating					Total	Percentage	Results
		Expert 1	Expert 2	Expert 3	Expert 4	Expert 5			
1	Whole	Agree	Agree	Agree	Agree	Agree	5	100%	Valid
2	TK Dimension	Agree	Agree	Agree	Agree	Agree	5	100%	Valid
3	PK Dimension	Agree	Agree	Agree	Agree	Agree	5	100%	Valid
4	CK Dimension	Agree	Agree	Agree	Agree	Agree	5	100%	Valid
5	TPK Dimension	Agree	Agree	Agree	Agree	Agree	5	100%	Valid
6	TCK Dimension	Agree	Agree	Agree	Agree	Agree	5	100%	Valid
7	PCK Dimension	Agree	Agree	Agree	Agree	Agree	5	100%	Valid
8	TPCK Dimension	Agree	Agree	Agree	Agree	Agree	5	100%	Valid

Expert Assessment Form 3

No.	Content	Detail	Assessment Results of Utility			Remarks
			Agree	Partially Agree	Disagree	
1	Strategy Development Basis	(1) Current status of TPACK for teacher internship students (2) Contents of TPACK promotion strategies in high-quality literature				
2	Strategy Development Principles	(1) Combined with the learning characteristics of this stage of educational internship (2) Promote teacher internship students' integration and application of TPAKC ability in teaching practice				
3	Strategy Development Content	(1) Improving the TK, PK and CK abilities of primary school teacher internship students. (2) Enhance teacher internship students' TPACK integration factors TPK, TCK, PCK, TPCK through teaching observation and teaching reflection				
4	Strategy effectiveness Assessment	After the education internship, a CIPP assessment of the implementation of the strategy will be conducted.				

Expert Assessment Form 3 (Continued)

No.	Content	Detail	Assessment Results of Feasibility			Remarks
			Agree	Partially Agree	Disagree	
1	Strategy Development Basis	(1) Current status of TPACK for teacher internship students (2) Contents of TPACK promotion strategies in high-quality literature				
2	Strategy Development Principles	(1) Combined with the learning characteristics of this stage of educational internship (2) Promote teacher internship students' integration and application of TPAKC ability in teaching practice				
3	Strategy Development Content	(1) Improving the TK, PK and CK abilities of primary school teacher internship students. (2) Enhance teacher internship students' TPACK integration factors TPK, TCK, PCK, TPCK through teaching observation and teaching reflection				
4	Strategy effectiveness Assessment	After the education internship, a CIPP assessment of the implementation of the strategy will be conducted.				

Expert Assessment Form 3 (Continued)

No.	Content	Detail	Assessment Results of Propriety			Remarks
			Agree	Partially Agree	Disagree	
1	Strategy Development Basis	(1) Current status of TPACK for teacher internship students (2) Contents of TPACK promotion strategies in high-quality literature				
2	Strategy Development Principles	(1) Combined with the learning characteristics of this stage of educational internship (2) Promote teacher internship students' integration and application of TPAKC ability in teaching practice				
3	Strategy Development Content	(1) Improving the TK, PK and CK abilities of primary school teacher internship students. (2) Enhance teacher internship students' TPACK integration factors TPK, TCK, PCK, TPCK through teaching observation and teaching reflection				
4	Strategy effectiveness Assessment	After the education internship, a CIPP assessment of the implementation of the strategy will be conducted.				

Expert Assessment Form 3 (Continued)

No.	Content	Detail	Assessment Results of Accuracy			Remarks
			Agree	Partially Agree	Disagree	
1	Strategy Development Basis	(1) Current status of TPACK for teacher internship students (2) Contents of TPACK promotion strategies in high-quality literature				
2	Strategy Development Principles	(1) Combined with the learning characteristics of this stage of educational internship (2) Promote teacher internship students' integration and application of TPAKC ability in teaching practice				
3	Strategy Development Content	(1) Improving the TK, PK and CK abilities of primary school teacher internship students. (2) Enhance teacher internship students' TPACK integration factors TPK, TCK, PCK, TPCK through teaching observation and teaching reflection				
4	Strategy effectiveness Assessment	After the education internship, a CIPP assessment of the implementation of the strategy will be conducted.				

Table Appendix 3: Assessment Results of the designed TPACK improvement strategy

No.	Item	Expert' rating of Utility					Total	Percentage	Results
		Expert 1	Expert 2	Expert 3	Expert 4	Expert 5			
1	Strategy development basis	Agree	Agree	Agree	Agree	Agree	5	100%	Valid
2	Strategy development principles	Agree	Agree	Agree	Agree	Agree	5	100%	Valid
3	Strategy development content	Agree	Agree	Agree	Agree	Agree	5	100%	Valid
4	Strategy effectiveness assessment	Agree	Agree	Agree	Agree	Agree	5	100%	Valid

Table Appendix 3 (Continued)

No.	Item	Expert' rating of Feasibility					Total	Percentage	Results
		Expert 1	Expert 2	Expert 3	Expert 4	Expert 5			
1	Strategy development basis	Agree	Agree	Agree	Agree	Agree	5	100%	Valid
2	Strategy development principles	Agree	Agree	Agree	Agree	Agree	5	100%	Valid
3	Strategy development content	Agree	Agree	Agree	Agree	Agree	5	100%	Valid
4	Strategy effectiveness assessment	Agree	Agree	Agree	Agree	Agree	5	100%	Valid

Table Appendix 3 (Continued)

No.	Item	Expert' rating of Propriety					Total	Percentage	Results
		Expert 1	Expert 2	Expert 3	Expert 4	Expert 5			
1	Strategy development basis	Agree	Agree	Agree	Agree	Agree	5	100%	Valid
2	Strategy development principles	Agree	Agree	Agree	Agree	Agree	5	100%	Valid
3	Strategy development content	Agree	Partially Agree	Agree	Agree	Agree	4	80%	Valid
4	Strategy effectiveness assessment	Agree	Agree	Agree	Agree	Agree	5	100%	Valid

Table Appendix 3 (Continued)

No.	Item	Expert' rating of Accuracy					Total	Percentage	Results
		Expert 1	Expert 2	Expert 3	Expert 4	Expert 5			
1	Strategy development basis	Agree	Agree	Agree	Agree	Agree	5	100%	Valid
2	Strategy development principles	Agree	Agree	Agree	Agree	Agree	5	100%	Valid
3	Strategy development content	Agree	Partially Agree	Agree	Agree	Agree	4	80%	Valid
4	Strategy effectiveness assessment	Agree	Agree	Agree	Agree	Agree	5	100%	Valid

Expert Assessment Form 4

Grade	TK Dimension	Assessment Results			Remarks
		Agree	Partially Agree	Disagree	
Excellent	Have excellent information technology proficiency and be able to flexibly use PPT, Word and other tools to quickly obtain high-quality Chinese teaching resources. creatively produce PPTs, actively solve technical problems in teaching, maintain a desire to learn emerging technologies, and constantly optimize teaching applications.				
Good	Proficient in using teaching support tools such as PPT and Word to quickly locate applicable teaching resources. able to produce clear and content-rich PPTs, solve general technical problems, and have a certain enthusiasm for learning new technologies.				
Average	Have basic information technology application ability and be able to complete regular teaching needs. can found some Chinese teaching resources on the Internet and can make basic PPTs and solve some common technical problems, but it takes a certain amount of time.				
Passable	Basic application of information technology, searching for limited resources, making basic PPT, and solving simple technical problems. the enthusiasm for learning needs to be encouraged, and the ability to accept new technologies is limited.				
Poor	Have difficulty applying technology and need help from others to find resources and solve problems. limited ability to make PPT, difficulty in solving common technical problems, and lack of motivation to learn new technologies.				

Expert Assessment Form 4 (Continued)

Grade	PK Dimension	Assessment Results			Remarks
		Agree	Partially Agree	Disagree	
Excellent	Skillfully apply the teacher-led and student-centered teaching model, and flexibly use a variety of evaluation methods to fully understand student learning. ability to flexibly adjust teaching strategies based on academic conditions and student performance to ensure teaching effectiveness. among different Chinese teaching modules, the most suitable teaching methods are accurately selected to enhance students' learning experience.				
Good	The teacher-led and student-centered teaching model is flexibly applied, and a variety of evaluation methods are used to comprehensively grasp student learning conditions. be able to make reasonable adjustments to teaching based on academic conditions and student performance to ensure teaching effectiveness. In different Chinese teaching modules, different teaching methods can be used to promote student learning effects.				
Average	The teacher-led and student-centered teaching model can be applied, and a variety of evaluation methods can be used to understand student learning. adjust teaching according to academic situation and student performance to ensure basic teaching effects. choose an appropriate teaching method among different Chinese teaching modules to support student learning.				
Passable	The teacher-led and student-centered teaching model is basically used, and a variety of evaluation methods are used to obtain student learning information. make certain degree of teaching adjustments based on academic situation and student performance to ensure teaching progress. choose a more appropriate teaching method among different Chinese teaching modules to support student learning.				
Poor	It is difficult to apply the teacher-led, student-centered teaching model, and the evaluation method is single. teaching adjustments to academic performance and student performance are limited, which may affect teaching effectiveness. the selection of teaching methods among different Chinese teaching modules is relatively single and provides insufficient support for students' learning.				

Expert Assessment Form 4 (Continued)

Grade	CK Dimension	Assessment Results			Remarks
		Agree	Partially Agree	Disagree	
Excellent	Have excellent knowledge of Chinese and be able to formulate practical teaching plans and clarify the knowledge content and difficulties of each class. proficient in using professional Chinese knowledge to solve teaching problems, and comprehensively master the pinyin, grammar, style, reading, homework, language application and other knowledge required for primary school Chinese teaching.				
Good	Have strong knowledge of Chinese, be able to formulate effective teaching plans, and grasp the knowledge content and difficulties of each class. proficient in using professional Chinese knowledge to solve teaching problems, and familiar with pinyin, grammar, style, reading, homework, language application and other knowledge required for primary school Chinese teaching.				
Average	Have basic knowledge of Chinese, formulate general teaching plans, and be able to clearly grasp the knowledge content of each class. be able to use professional Chinese knowledge to solve some teaching problems, and be familiar with pinyin, grammar, style, reading, homework, language application and other knowledge required for primary school Chinese teaching.				
Passable	Have certain knowledge of Chinese, formulate basic teaching plans, and be able to barely grasp the knowledge content of each class. be able to use professional Chinese knowledge to solve some simple teaching problems, and understand the pinyin, grammar, style, reading, homework, language application and other knowledge required for primary school Chinese teaching.				
Poor	Limited knowledge of Chinese subjects makes it difficult to formulate teaching plans and grasp knowledge content. It is difficult to solve teaching problems, and there is insufficient understanding of pinyin, grammar, style, reading, homework, language application and other knowledge required for primary school Chinese teaching.				

Expert Assessment Form 4 (Continued)

Grade	TPK Dimension	Assessment Results			Remarks
		Agree	Partially Agree	Disagree	
Excellent	Use information technology to stimulate primary school students' interest in Chinese learning, and use technology skillfully to improve the effectiveness of teaching methods. can cleverly create Chinese teaching situations, use technical means to deepen students' memory of new words and promote understanding of articles. comprehensive assessment of student learning through technical means, timely adjustment of teaching strategies to ensure efficient teaching.				
Good	Use information technology to stimulate primary school students' interest in Chinese learning and effectively improve teaching methods. can use technical means to create Chinese teaching situations, strengthen students' memory of new words, and help them understand articles. able to use technical means to comprehensively evaluate students' learning status and make reasonable adjustments to teaching.				
Average	Demonstrating basic skills in the use of information technology can barely stimulate students' interest in Chinese learning. use technical means to create Chinese teaching situations to help students memorize new words and understand articles. able to use technical means to make simple assessments of student learning and make some teaching adjustments.				
Passable	Preliminary use of information technology to stimulate students' interest in Chinese learning and try to improve teaching effects. use technical means to create simple Chinese teaching situations to help students memorize new words. ability to simply assess student learning through technical means and try to adjust teaching.				
Poor	There are major deficiencies in the application of information technology, which fails to effectively stimulate students' interest in Chinese learning. The ability to create Chinese teaching situations through technical means is limited, and it is difficult to evaluate students' learning status and adjust teaching.				

Expert Assessment Form 4 (Continued)

Grade	TCK Dimension	Assessment Results			Remarks
		Agree	Partially Agree	Disagree	
Excellent	Skillfully apply information technology to promote primary school students' understanding and mastery of Chinese knowledge, and organically integrate Chinese knowledge and information technology functions to achieve the best learning results.				
Good	Use information technology more skillfully to promote primary school students' understanding and mastery of Chinese knowledge, and be able to match Chinese knowledge with information technology to achieve good learning results.				
Average	The basic application of information technology promotes primary school students' understanding and mastery of Chinese knowledge, and can better match Chinese knowledge and information technology to achieve general learning effects.				
Passable	Try to apply information technology to promote primary school students' understanding and mastery of Chinese knowledge, and initially match Chinese knowledge with information technology to achieve some learning effects.				
Poor	There are major deficiencies in the application of information technology, which fails to effectively promote primary school students' understanding and mastery of Chinese knowledge, and the matching effect is poor.				

Expert Assessment Form 4 (Continued)

Grade	PCK Dimension	Assessment Results			Remarks
		Agree	Partially Agree	Disagree	
Excellent	Accurately adjust Chinese teaching materials, use a variety of teaching methods to solve key and difficult points according to learning conditions, and predict student mistakes. develop teaching plans based on standards, resources, and learning conditions, effectively conduct classroom management, and achieve efficient teaching.				
Good	Appropriately adjust the teaching materials, select appropriate teaching methods according to different contents to solve knowledge difficulties, and more accurately predict students' mistakes. develop reasonable teaching plans, conduct effective classroom management, and promote student learning.				
Average	Adjust teaching materials and choose appropriate teaching methods to solve difficult knowledge points and basically predict student mistakes. develop reasonable teaching plans, conduct basic classroom management, and support student learning.				
Passable	Try to adjust teaching materials, choose basic and appropriate teaching methods to solve knowledge difficulties, and initially predict students' mistakes. simply formulate teaching plans, conduct basic classroom management, and support student learning.				
Poor	There are major deficiencies in adjusting teaching materials and selecting teaching methods, failing to effectively solve knowledge difficulties and accurately predict student mistakes. teaching planning and classroom management are relatively weak, and support for student learning is limited.				

Expert Assessment Form 4 (Continued)

Grade	TPCK Dimension	Assessment Results			Remarks
		Agree	Partially Agree	Disagree	
Excellent	Selected information technology is used to optimize teaching and promote students' understanding and mastery of Chinese knowledge. use information technology skillfully to create language situations, effectively combine language, technology and pedagogical, and proactively think about how to better integrate the three to promote teaching activities.				
Good	Can choose information technology to optimize Chinese teaching and create situations to promote students' understanding and mastery of Chinese knowledge. combining Chinese, technology and pedagogical more skillfully, thinking about ways to integrate the three in Chinese classes, and carrying out teaching activities.				
Average	Basically be able to apply information technology to optimize teaching and create language situations to help students understand and master. able to combine Chinese, technology and pedagogical in a relatively basic way, and to a certain extent, think about the possibility of integrating the three in the Chinese classroom and carry out teaching activities.				
Passable	Try to apply information technology to optimize Chinese teaching and create basic situations to help students understand. preliminarily combine Chinese, technology and pedagogical, and consider integrating the three in the Chinese classroom to a limited extent to start teaching.				
Poor	There are major deficiencies in the application of information technology and failure to effectively optimize Chinese teaching. It is difficult to integrate Chinese, technology and pedagogical, and teaching activities are limited.				

Table Appendix 4: Expert assessment results of TPACK assessment criteria for primary school teacher internship students

No.	Item	Expert' rating					Total	Percentage	Results
		Expert 1	Expert 2	Expert 3	Expert 4	Expert 5			
1	TK Dimension	Agree	Agree	Agree	Partially Agree	Agree	4	80%	Valid
2	PK Dimension	Agree	Agree	Agree	Partially Agree	Agree	4	80%	Valid
3	CK Dimension	Agree	Agree	Agree	Partially Agree	Agree	4	80%	Valid
4	TPK Dimension	Agree	Agree	Agree	Partially Agree	Agree	4	80%	Valid
5	TCK Dimension	Agree	Agree	Agree	Partially Agree	Agree	4	80%	Valid
6	PCK Dimension	Agree	Agree	Agree	Partially Agree	Agree	4	80%	Valid
7	TPCK Dimension	Agree	Agree	Agree	Partially Agree	Agree	4	80%	Valid

Expert Assessment form 5

No.	Content	Detail	Opinion of the Specialists			Remarks
			Agree	Partially Agree	Disagree	
1	Context	(1) The requirements for teachers in the digital age. (2) Current status of teacher internship students' TPACK ability. (3) Educational internship is the best period to improve the TPACK ability of normal college students (4) The goal is set to improve the TPACK ability of teacher internship students to "Average" level				
2	Input	Course training plan (Appendix D)				
3	Process	(1) Performance of teacher internship students in training sessions. (2) Completion status of teacher internship students' assignments. (3) Interaction between course training instructors and teacher internship students.				
4	Product	(1) Performance of teacher interns in training courses. (2) Assessment of teacher internship students by internship school tutors. (3) Assessment of teacher internship students by primary school students in the internship school. (4) Teacher internship students TPACK post-test scores. (5) Self-assessment of teacher internship students. (6) Peer-assessment of teacher internship students.				

Table Appendix 5: Evaluation Results of the implementation of TPACK improvement strategy

No.	Item	Expert' rating					Total	Percentage	Results
		Expert 1	Expert 2	Expert 3	Expert 4	Expert 5			
1	Context	Agree	Agree	Agree	Agree	Agree	5	100%	Valid
2	Input	Agree	Partially Agree	Agree	Agree	Agree	4	80%	Valid
3	Process	Agree	Agree	Agree	Agree	Agree	5	100%	Valid
4	Product	Agree	Agree	Agree	Agree	Agree	5	100%	Valid

Appendix D

Research Instrument

- Test Paper I

- Test Paper 2

- Training program

TPACK test paper 1 for teacher internship students in the Chinese direction of elementary education major

Single choice questions

TK (Technological Knowledge)

1. Which of the following electronic products integrates learning resources such as textbooks, homework books, extracurricular and extracurricular readings, dictionaries, etc. ( ). (2 points)
A. E-school bag**电子书包**
B. Micro course**微课程**
C. Seewo whiteboard**希沃白板**
D. Laptop**笔记本电脑**
Correct answer: A

2. In a broad sense, the process included in information retrieval is ( ). (2 points)
A. Storage and retrieval
B. Collect and share
C. Search and feedback
D. Collection and utilization
Correct answer: A

3. To jump from the fifth slide to the eighth slide, you can use ( ). (2 points)
A. Delete three slides
B. Add flash
C. Shift+F8
D. Add a hyperlink
Correct answer: D

4. Which of the following items is not included in the insertion object of PowerPoint 2016 ( ). (2 points)
A. Symbol
B. Video
C. Audio
D. Shape
Correct answer: A
5. Which of the application modes provided by Seewo Whiteboard 5 does not include? ( ) (3 points)
A. Writing mode

B. Interactive mode
C. Listening mode
D. Web page mode
Correct answer: C

6. Cloud computer resources are stored on ( ). (2 points)
A. Peer-to-peer network
B. Wide area network
C. Internet
D. Wireless network
Correct answer: C

PK (Pedagogical Knowledge)
1. Please arrange the order of teaching objectives, educational objectives and training objectives from macro to micro ( ) (2 points)
A. Training goals→Teaching goals→Educational purposes
B. Teaching purpose→Educational goal→Training goal
C. Educational purpose→Training goal→Teaching goal
D. Training goals→Educational goals→Training goals
Correct answer: C

2. The "activities of ( )" organized by teachers actually refer to the teachers' teaching sessions. (2 points)
A. Teach
B. Learn
C. Thinking
D. Discuss
Correct answer: B

3. Teachers impart knowledge and concepts through presentations and demonstrations in class to help students promote the digestion and memory of knowledge. This method is called ( ). (2 points)
A. Demonstration method
B. Lecture method
C. Situational teaching method
D. Project-driven teaching method
Correct answer: A

4. One of the main purposes of teachers assigning after-school homework is to cultivate students' ( ) learning ability through after-school homework. (2 points)
A. Critical thinking
B. Creative thinking
C. Independence
D. Obey
Correct answer: C

5. Blackboard design is a plan about ( ) two aspects made by the teacher before class. (2 points)
A. Topic and content
B. Content and learning methods
C. Content and form
D. Key points and difficulties
Correct answer: C

6. Teaching evaluation can be divided into ( ) according to its role in teaching. (2 points)
A. Diagnostic assessment, formative assessment and summative assessment
B. Self-evaluation and peer evaluation
C. Oral evaluation and written evaluation
D. Goal-oriented evaluation and comprehensive evaluation
Correct answer: A

CK (Content Knowledge)
1. Among the following statements about famous works, one of the incorrect ones is ( ) (3 points)
A. "Family" is one of Mr. Ba Jin's masterpieces. It describes the sin and corruption of a large feudal family in the early 1920s, indicts the feudal system's destruction of life, and praises the anti-feudal struggle of the young generation and the awakening of democracy
B. "Grimm's Fairy Tales" is a collection of German folk literature collected, organized and processed by the German linguists Jacob Grimm and Wilhelm Grimm brothers. It includes such well-known fairy tales as "Cinderella", "Snow White", "Little Red Riding Hood" and "The Frog Prince" All from this book
C. The authors of "Journey to the West", "A Dream of Red Mansions", "Gulliver's Travels" and "Robinson Crusoe" are Shi Naian, Wu Cheng'en, Jonathan Swift and Hans Christian Andersen respectively

D. "One Hundred Years of Solitude" is the representative work of Colombian writer García Márquez and a representative work of Latin American magical realism literature. It is known as "a masterpiece that reproduces the historical and social picture of Latin America."
Correct answer: C

2. The poetry of the Tang Dynasty poet ( ) was evaluated by Su Shi as "high rhyme but short talent, like making a wine master with internal skills but no materials." (2 points)
A. Li Bai
B. Meng Haoran
C. Gao Shi
D. Wang Changling
Correct answer: B

3. Which of the following reasons does "holding hands and looking into tearful eyes, speechless and choking"(**执手相看泪眼，竟无语凝噎**) belong to the following reasons? ( ) (3 points)
A. Love sickness
B. Leave and travel far away
C. Tired of traveling
D. Looking forward to returning
Correct answer: B

4. Which of the following poems is translated as: The spring river tide is mighty and connected with the sea, and a bright moon rises from the sea, as if pouring out together with the tide. ( )(3 points)
A. **海上生明月，天涯共此时**
B. **一千里色中秋月，十万军声半夜潮**
C. **海日生残夜，江春入旧年**
D. **春江潮水连海平，海上明月共潮生**
Correct answer: D

TPK (Technological Pedagogical Knowledge)
1. The requirements for blended teaching design do not include ( ) (2 points)
A. Maintain absolute silence during classroom teaching
B. Integrate online teaching and offline teaching
C. Provide timely feedback

D. Clear learning goals
Correct answer: A

2. The English abbreviation of small-scale restricted online courses is ( ).(2 points)
A. cMOOC
B. SPOC
C. xMOOC
D. tMOOC
Correct answer: B

3. Which of the following does not include the role of technology in classroom teaching? ( )(2 points)
A. Technology optimizes learning experience
B. Technology provides personalized learning
C. Technology improves teaching efficiency
D. Technology improves teachers' class management ability
Correct answer: D

4. Regarding traditional teaching and flipped classroom teaching, which of the following statements is incorrect? ( ) (2 points)
A. The tests conducted in both modes are designed to rank students based on their scores.
B. The teaching process of both includes three parts: before class, class and after class.
C. The former's homework is usually completed outside the classroom, while the latter's homework is to prepare for discussions in class.
D. In the former, teachers mainly play the role of imparting knowledge, while in the latter, teachers play more of a guide and problem solver.
Correct answer: A

5. Among the electronic interactive functions, which of the following interactive methods can improve classroom activity? ( ) (2 points)
A. Visual interaction
B. Touch interaction
C. Inductive interaction
D. Playful interaction
Correct answer: D

TCK (Technological Content Knowledge)

1. Which of the following APPs has rich teaching resources that can help primary school Chinese teachers prepare lessons? ( ) (2 points)
A. 101 Education PPT
B. 102 Education PPT
C. 101 Education
D. 102 Education
Correct answer: A

2. ( ) is an APP that can help primary school Chinese teachers correct compositions. (2 points)
A. Homework help作业帮
B. Homework pie**作业派**
C. Marking master**阅卷大师**
D. All of the above are OK
Correct answer: D

3. Which of the following APPs has developed "Chinese character stroke order and writing" through animation demonstration and follow-up writing to teach children to learn to write stroke by stroke. ( ) (2 points)
A. Little Ape Search Questions**小猿搜题**
B. Youdao Children's Dictionary of words**有道少儿字典**
C. Youdao Children's Dictionary **有道少儿词典**
D. Dictionary of ancient poetry**古诗词典**
Correct answer: C

4. In primary school Chinese writing classes, teachers encourage students to share and correct other students' compositions. Which of the following would be most helpful in achieving this collaborative writing goal? ( )(2 points)
A. Paper composition
B. Email
C. Electronic document sharing platform**电子文档共享平台**
D.Traditional writing board
Correct answer: C

5. Which of the following is not a professional reading APP ( ).(2 points)
A. Himalaya **喜马拉雅**
B. Yimi Reading **一米阅读**

C. Yunshang Academy **云上书院**
D. JiaoJiao Reading**叫叫阅读**
Correct answer: A

PCK (Pedagogical Content Knowledge)
1. When teaching the word "漂", students should pay attention to the fact that the word has a left-right structure rather than a non-up-and-down structure. This is ( ). (3 points)
A. Improve students' interest in learning
B. Prevent the interference of uncommon words
C. Strengthen students' understanding of Chinese characters with similar glyphs
D. Strengthen students' memory of easily misspelled glyphs
Correct answer: D

2. Regarding poetry teaching, which of the following is wrong ( )? (3 points)
A. The main goal of primary school poetry teaching is to experience the poet's emotions, taste the language of poetry, and imagine the situation of poetry.
B. The main teaching goal of primary school poetry teaching is to master the style of poetry.
C. Poetry accounts for a large proportion in primary school Chinese textbooks.
D. Primary school Chinese poems are mainly five-character poems and seven-character poems.
Correct answer: B

3. Guide students to learn the meaning of the word "water and sky meet"(**水天相接**) in the lesson "Tide Observation"(《**观潮**》). The most suitable method is ( ). (3 points)
A. Combined with the text
B. Create learning situations
C. Combined with life experience
D. Combined with teacher's narration
Correct answer: A

4. Which of the following is not a key point in the reconstruction design of Pinyin contextualized teaching ( ) (3 points)
A. Lyrics
B. Lifestyle
C. Knowledge
D. Gamification

Correct answer: C

TPCK (Technological Pedagogical Content Knowledge)

1. What is the "TPACK" knowledge that contemporary teachers should have ( ) (2 points)
A. Technological Pedagogical Knowledge
B. Technological Pedagogical Content Knowledge
C. Pedagogical Content knowledge
D. Technological Content knowledge
Correct answer: B

2. When a primary school Chinese teacher considers the use of modern educational technology, in which aspect is his critical thinking most critical? ( )(2 points)
A. Choose to use popular educational apps, thinking they are often the most effective
B. Consider how technology tools can be used to meet the different learning needs of students
C. Refuse to use electronic devices to avoid technology interference on students
D. Try all new technology tools, whether related to teaching content or not, to stay updated
Correct answer: B

Multiple choice questions

TK (Technological Knowledge)

1. Common audio file formats are ( ).(4 points)
A. MP3
B. WAV
C. MP4
D. AVI
Correct answer: AB

PK (Pedagogical Knowledge)

2. What factors should teachers consider when choosing teaching methods ( ).(4 points)
A. Students' academic status
B. Teaching resources
C. Learning style
D. Classroom environment
Correct answer: ABCD

CK (Content Knowledge)

3. The following Chinese character structures are ideographic characters ( ).(4 points)

A. 花

B. 吠

C. 休

D. 歪

Correct answer: BCD

TPK (Technological Pedagogical Knowledge)

4. What are the commonly used tools for teaching evaluation? ( )(4 points)

A. SPSS

B. Photoshop

C. Mendeley

D. Free Quizmaker

Correct answer: AD

TCK (Technological Content Knowledge)

5. What are the basic functions of Kaola Reading APP? ( )(4 points)

A. Special reading training

B. Teacher reading management

C. Intelligent reading recommendations

D. Student interaction

Correct answer: ABCD

PCK (Pedagogical Content Knowledge)

6. The basic characteristics of comprehensive Chinese learning are ( ).(4 points)

A. Comprehensive

B. Vividness

C. Practicality

D. Literary

Correct answer: AC

TPCK (Technological Pedagogical Content Knowledge)

7. The following descriptions of TPACK are correct ( ).(4 points)

A. TPACK was developed by Punya Mishra and Matthew Koehler in 2003.

B. TPACK is a comprehensive framework designed to guide teachers on how to integrate technology into subject matter instruction.

C. The three core elements of the TPACK framework are technological knowledge, pedagogical knowledge, and subject matter knowledge, which are independent of each other.
D. The TPACK framework encourages teachers to be innovative in their teaching methods and to utilize technological tools to enhance students' learning experiences.
Correct answer: BD

TPACK test paper 2 for teacher internship students in the Chinese direction of primary education major

Single choice questions

TK (Technological Knowledge)

1. Which of the following formats is the format of dynamic pictures? ( ) (2 points)
A. JPEG
B. WAV
C. FLAC
D. GIF
Correct answer: D

2. For ( ), we need to use "logical OR" for information retrieval. (2 points)
A. Improve accuracy
B. Improve query speed
C. Improve recall rate
D. Reduce the missed detection rate
Correct answer: C

3. In word, the key that can quickly move the cursor to the beginning of the document is ( ). (2 points)
A. Ctrl+Home
B. Ctrl+Shift+Alt
C. Ctrl+Enter
D. Ctrl+Shift+Tab
Correct answer: A

4. Except for ( ), the other methods below can obtain pictures. (2 points)
A. PrintScreen
B. Ctrl+Alt+A
C. Ctrl+C
D. Alt key+PrintScreen
Correct answer: C

5. We can download various resources through the Internet and store our own information in cyberspace. These mainly benefit from the ( ) function of the network. (2 points)
A. Long distance transmission

B. Data storage
C. Resource sharing
D. Dispersed processing
Correct answer: C

6. Two teachers respectively modified the same article through the revision function of Word. Which of the following methods is the most optimal way to merge the two modified documents into one ( ). (3 points)
A. Open the document with more revisions and manually enter the modifications of the document with less revisions
B. Use the Word comparison function to merge the revisions of the two teachers into one document
C. Ask the teacher with fewer revisions to revise the document with more revisions
D. Only keep the opinions of the teacher who revised more, and ignore the ones who revised less
Correct answer: B

PK (Pedagogical Knowledge)
1. Evaluation before the start of classroom teaching is called ( ). (2 points)
A. Formative assessment
B. Diagnostic evaluation
C. Comprehensive evaluation
D. Subjective evaluation
Correct answer: B

2. Teaching reflection is a kind of dialogue, specifically ( ). (2 points)
A. Dialogue between students
B. Dialogue between teachers and students
C. Teacher-to-teacher dialogue
D. Dialogue between teaching theory and practice
Correct answer: D

3. According to the academic situation and ( ), the activity process in which teachers promote students' learning from the starting point to the end in the classroom is called the classroom teaching process. (2 points)
A. Teaching objectives
B. Teaching content
C. Teaching plan

D. Teaching effect
Correct answer: A

4. What is the correct understanding of learning scaffolding( ). (2 points)
A. Learning scaffolds are flexible and diverse, but they all need to be designed in advance before class.
B. The purpose of providing learning scaffolds is to help teachers teach better
C. The form of learning scaffolding will not change with different tasks and different scaffolding purposes
D. Teachers further manage students' learning by providing learning scaffolds
Correct answer: D

5. Zi Lu asked: "Have you heard this and done this?" Confucius said: "If your father and brother are here, how can you hear this and do this?" Ran You asked: "Have you heard this and do this?" Confucius said: "Hearing this and do this." In this dialogue, Confucius used the teaching principle of ( ). (2 points)
A. Scientific
B. Intuition
C. Teach students in accordance with their aptitude
D. Ideology
Correct answer: C

6. What is the most important thing in the lesson presentation?( )(2 points)
A. Teachings
B. Teaching process
C. Study
D. Teaching objectives
Correct answer: B

CK (Content Knowledge)
1. Which of the following knowledge judgments is incorrect? ( ) (3 points)
A. "Spring", "is" and "beautiful" are nouns, verbs and adjectives respectively.
B. "Correct attitude(态度端正)", "Full of energy(**精力充沛**)" and "Love life(热爱生活)" are all subject and predicate phrases.
C. "Comrade Bethune's spirit of not benefiting himself but only benefiting others inspires us." is a single sentence.

D. "A single thread cannot make a thread, and a single tree cannot make a forest." is a parallel complex sentence.
Correct answer: B

2. For the word "**黄**", search the（ ）radical according to the radical search method. (3 points)
A. 黄
B. 共
C. 由
D. 艹
Correct answer: A

3. "Looking at the flowers with tears in my eyes, I am silent, and the red flowers fly across the swing.(**泪眼看花花不语，乱红飞过秋千去**)" According to Wang Guowei's "Human Words", what kind of state does this poem express? ( )(3 points)
A. Nature
B. The realm of separation
C. The state of selflessness
D. There is a realm of me
Correct answer: D

4. Which of the following does not belong to Shakespeare's four comedies? ( ) (2 points)
A. The Merchant of Venice
B. A Midsummer Night's Dream
C. Twelfth Night
D. Hamlet
Correct answer: D

TPK (Technological Pedagogical Knowledge)
1. Which of the following is not a characteristic of micro-courses? ( )(2 points)
A. Less teaching content
B. Rich in content
C. Shorter teaching time
D. Resource capacity is small
Correct answer: B

2. The flipped classroom meets the needs of different students through ( ) methods. (2 points)
A. Watch the instructional video repeatedly
B. Learn better by teaching others
C. Ask teachers and classmates for advice
D. You can do things that interest you
Correct answer: A

3. The characteristics of classroom teaching courseware are ( ).(2 points)
A. Usually made with PPT software
B. Play a supporting role in teachers' classroom teaching
C. Help students better understand and master key and difficult points
D. All the above statements are correct
Correct answer: D

4. In the evaluation of information-based teaching, the method that does not belong to performance evaluation is ( ). (2 points)
A. Exam paper
B. Simulated performance tasks
C. Do experiments or surveys
D. Oral description
Correct answer: A

5. The research object of educational technology is ( ). (2 points)
A. Information technology
B. Hardware technology and software technology
C. Learning process and learning resources
D. Teaching process and teaching resources
Correct answer: C

TCK (Technological Content Knowledge)
1. Which of the following methods can most effectively improve primary school students' interesting for learning Pinyin? ( )(2 points)
A. Set up a Pinyin passing game in PPT
B. Display rich Pinyin teaching pictures
C. Practice writing Pinyin extensively
D. Learn spelling by combining common objects in primary school students' lives
Correct answer: A

2. The learning website that Chinese teachers often use is （) (2 points)
A. National smart education platform for primary and secondary schools
B. Official website of People's Education Press
C. Chinese language fan
D. All of the above
Correct answer: D

3. Chinese teachers can use ( ) to help students sort out Chinese knowledge points in the form of images. (2 points)
A. Photoshop
B. Cutting
C. Mind map
D. Katyusha
Correct answer: C

4. When consolidating new words, Chinese teachers use （) to better improve students' learning enthusiasm. (2 points)
A. Set up game sessions in PPT to test new word learning
B. Ask students to copy new words repeatedly
C. Ask students to recite new words repeatedly
D. Ask students to compose words for new words
Correct answer: A

5. In order to help first-grade primary school students standardize their spelling of Chinese Pinyin, （) can be used to assist teaching. (2 points)
A. The teacher repeatedly spells out loud in class
B. The teacher asks students to spell the word repeatedly
C. The teacher plays high-quality Chinese Pinyin teaching audio resources on the Internet in class
D. None of the above are correct
Correct answer: C

PCK (Pedagogical Content Knowledge)
1. Among the statements about comprehensive Chinese learning in primary schools, the incorrect one is ( ). (3 points)
A. Comprehensive experience, understanding and creation of cultural knowledge, life experience, emotional experience and subject knowledge

B. The goal is to actively engage in exploratory learning, stimulate imagination and creative potential, and learn and use Chinese in practice
C. Based on the integration of Chinese courses, emphasize the connection between Chinese courses and other courses
D. It is necessary to highlight the comprehensive development of listening, speaking, reading and writing skills, especially the development of daily communication language skills
Correct answer: D

2. When teaching the character "土", compare it with the character "士" and let students notice that the horizontal stroke of the last stroke is shorter than the upper horizontal stroke. This is ( ). (3 points)
A. Strengthen primary school students' understanding of the meanings of similar words
B. Because the perception of primary school students is not refined
C. In order to know more new words
D. Improve students' imagination
Correct answer: B

3. Regarding oral communication teaching, one of the incorrect statements is ( ). (3 points)
A. It is the application of listening and speaking skills in actual communication
B. The roles of listening and speaking cannot be interchanged at any time
C. Conducted in a specific activity situation
D. It is an interactive process between listening and speaking
Correct answer: B

4. Regarding the practice teaching, one of the following statements is wrong ( ). (3 points)
A. The content of the exercises should be closely related to the actual life of children
B. Guide students to tell the truth, and inner thoughts in their compositions
C. Exercise training follows the order from writing to speaking
D. The goals of homework teaching are different at each stage
Correct answer: C

TPCK (Technological Pedagogical Content Knowledge)

1. In primary school Chinese teaching, a teacher considers using modern educational technology to improve classroom teaching. Which of the following best demonstrates this teacher's ability to think critically? ( )(2 points)
A. Choose a popular educational app because it is also popular in other schools
B. Try all new technology tools to stay up to date with the latest technology
C. Carefully analyze students' learning needs and select appropriate technology tools based on course objectives
D. Let students choose their favorite technology tools to increase their engagement
Correct answer: C

2. The ultimate goal of integrating information technology and curriculum is ( ). (2 points)
A. Effectively improve learning
B. Stimulate students' interest in learning
C. It helps teachers improve their teaching methods
D. Better play the leading role of teachers
Correct answer: A

Multiple choice questions

TK (Technological Knowledge)

1.Regarding information literacy, which of the following statements is correct ( ).(4 points)
A. Information literacy includes three levels: cultural literacy, information awareness and information skills
B. Information literacy refers to the ability to operate information technology
C. The essence of information literacy is a basic ability that global informatization requires people to possess
D. The core of information literacy is information knowledge
Correct answer: AC

PK (Pedagogical Knowledge)

2. Teachers guide students to acquire new knowledge or consolidate learned knowledge through the question-and-answer process with students. The teaching methods included in this process are ( ).(4 points)
A. Conversation method
B. Lecture method
C. Discussion method

D. Research method
Correct answer: ABCD

CK (Content Knowledge)
3. From the words and phrases "Now I am haggard, my hair is windy and misty, and I am afraid of going out at night. It is better to sit under the curtain and listen to people's laughter(**如今憔悴，风鬟雾鬓，怕见夜间出去。不如向、帘儿底下，听人笑**语)", we can understand the emotion and psychology of the author ( ).(4 points)
A. This sentence uses form to describe the spirit, and uses the disheveled hair on the temples to describe the current situation of aging and decadence
B. Express the author’s inner emotional pain, emotional embarrassment and emotional contradictions in his old age
C. Use other people’s laughter and joy to contrast your own loneliness and sadness
D. Care about one's own image and show strong vanity
Correct answer: ABC

TPK (Technological Pedagogical Knowledge)
4. Among the following options, which are hardware resources among information-based teaching resources ( ).(4 points)
A. Electronic books电子图书
B. Multimedia teaching software多媒体教学软件
C. E-school bag电子书包
D. Display显示器
Correct answer: CD

TCK (Technological Content Knowledge)
5. When teaching Bai Juyi's "Recalling Jiangnan(《忆江南》)", in order to let students feel the beauty of spring in the south of the Yangtze River described by the poet and stimulate students' interest in ancient poetry, what information technologies can be used? ( ) (4 points)
A. Make ancient style courseware that can reflect poetry
B. Selected guqin music as background music to facilitate the teacher's poetry recitation
C. Demonstrate animated courseware to deepen students’ understanding of poetry
D. Search for high-quality recitation audio of "Recalling Jiangnan" on the Internet for students to enjoy
Correct answer: ABCD

PCK (Pedagogical Content Knowledge)

6. The six main links included in writing teaching design are academic status detection, task analysis, core knowledge, scaffold design, and ( ).(4 points)

A. Writing skills

B. Drafting communication

C. Reflection on experience

D. Layout structure

Correct answer: BC

TPCK (Technological Pedagogical Content Knowledge)

7. Deeply integrating modern information technology with primary school Chinese teaching can achieve the effect of ( ).(4 points)

A. Create learning situations

B. Optimize the teaching process

C. Enrich teaching resources

D. Strengthen teaching evaluation

Correct answer: ABCD

Training program

Training module 1:

Consolidate and practice common information technology knowledge

No.	Training content	Theory class	Practice class
1	Acquisition, processing and processing of teaching resources	1	1
2	PPT courseware design and beautification	1	1
3	Introduction and application of primary school Chinese related APP functions	1	1
4	Modern teaching environment and application	1	1
5	Methods and troubleshooting of common information technology teaching equipment	1	1
6	Information and media literacy	2	0
A total of 12 hours		7	5

Training module 2:

Consolidation and practice of teaching method knowledge

No.	Training content	Theory class	Practice class
1	Related theories of learning	1	1
2	Common teaching methods	1	1
3	Instructional design	1	1
4	Classroom management	1	1
5	Personalized teaching	1	1
6	Teaching evaluation	1	1
A total of 12 hours		6	6

Training program (Continued)

Training module 3:

Consolidate and practice the basic knowledge of primary school Chinese

No.	Training content	Theory class	Practice class
1	Pinyin and Chinese character writing	2	0
2	Modern Chinese grammar	2	0
3	Common sense of literature	2	0
4	Cultural and sports knowledge	2	0
5	Reading understands knowledge	2	0
6	Basic writing knowledge	2	0
A total of 12 hours		12	0

Training Module 4:

Teaching practice and reflection of primary school Chinese TPACK

Order number	Training content	Theory class	Practice class
1	1. Watch the teaching video: i u ü y w (Teacher Deng, pinyin) https://www.bilibili.com/video/BV1VJ411g7TA?p=41 2. Students reflect on the instructional videos	0	2
2	1. Watch the teaching video: "Mouth Ear Eye" (Teacher Li,Literacy)https://www.bilibili.com/video/BV1VJ411g7TA?p=20 2. Students reflect on the instructional videos	0	2
3	1. Watch the teaching video: "Autumn" (Teacher Wu, Reading) https://www.bilibili.com/video/BV1VJ411g7TA?p=91 2. Students reflect on the instructional videos	0	2
4	1. Watch the teaching video: Wonderful Imagination (Teacher Chao, Writing) https://www.bilibili.com/video/BV1tZ4y1K7G7/?spm_id_from=333.337.search-card.all.click 2. Students reflect on the instructional videos	0	2

Training Module 4 (Continued)

Order number	Training content	Theory class	Practice class
5	1. Watch the teaching video: "We Are Friends" (Teacher Wang, Oral communication)https://www.bilibili.com/video/ BV1VJ411g7TA?p=112 2. Students reflect on the instructional videos	0	2
6	1. Watch the teaching view, frequency: Chinese Garden four (Teacher Jiang, Comprehensive learning) https://www.bilibili. com/video/BV1VJ411g7TA?p=116 2. Students reflect on the instructional videos	0	2
A total of 12 hours		0	12

Teaching content and schedule plan

Date	Name	Class	Among	
			theory class	practice class
March 12	Consolidation and practice of common Information technology knowledge (1) Acquisition, processing and processing of teaching resources	2	1	1
March 13	Teaching Method Knowledge Consolidation and Practice (1) Related theories of learning	2	1	1
March 14	Consolidation and Practice of Basic Knowledge of Primary School Chinese Language (1) Pinyin and Chinese character writing	2	2	0
March 15	Consolidation and practice of common Information technology knowledge (2) PPT Courseware design and beautification	2	1b	1
March 18	Teaching Method Knowledge Consolidation and Practice (2) Common teaching methods	2	1	1
March 19	Consolidation and Practice of Basic Knowledge of Primary School Chinese (2) Modern Chinese grammar	2	2	0
March 20	Consolidation and practice of common Information technology knowledge (3) Introduction and application of primary school Chinese related APP functions	2	1	1
March 21	Teaching Method Knowledge Consolidation and Practice (3) instructional design	2	1	1
March 22	Consolidation and Practice of Basic Knowledge of Primary School Chinese Language (3) common sense of literature	2	2	0

Teaching content and schedule plan (Continued)

Date	Name	Class	Among	
			theory class	practice class
March 25	Consolidation and practice of common Information technology knowledge (4) Modern teaching environment and application	2	1	1
March 26	Knowledge Consolidation and Practice (4) Classroom management	2	1	1
March 27	Consolidation and Practice of Basic Knowledge of Primary School Chinese Language (4) Cultural and sports knowledge	2	2	0
March 28	Consolidation and practice of common Information technology knowledge (5) Methods and troubleshooting of common information technology teaching equipment	2	1	1
March 29	Teaching Method Knowledge Consolidation and Practice (5) Personalized teaching	2	1	1
April 1	Consolidation and Practice of Basic Primary School Chinese Knowledge (5) Reading understands knowledge	2	2	0
April 2	Consolidation and practice of common Information technology knowledge (6) Information and media literacy	2	2	0
April 3	Teaching Method Knowledge Consolidation and Practice (6) teaching evaluation	2	1	1
April 4	Consolidation and Practice of Basic Knowledge of Primary School Chinese (6) Basic writing knowledge	2	2	0

Teaching content and schedule plan (Continued)

Date	Name	Class	Among	
			theory class	practice class
April 5	TPACK Teaching Practice and Reflection in Primary School Chinese (1) 1. Watch the teaching video: i u ü y w (Teacher Deng, Pinyin) https://www.bilibili.com/video/BV1VJ411g7TA?p=41 2. Students reflect on the instructional videos	2	0	2
April 8	TPACK Teaching Practice and Reflection in Primary School Chinese (2) 1. Watch the teaching video: "Mouth Ear Eye" (Teacher Li,Recognizing Chinese Characters and Writing Chinese Characters) https://www.bilibili.com/video/BV1VJ411g7TA?p=20 2. Students reflect on the instructional videos	2	0	2
April 9	TPACK Teaching Practice and Reflection in Primary School Chinese (3) 1. Watch the teaching video: "Autumn" (Teacher Wu, Reading) https://www.bilibili.com/video/BV1VJ411g7TA?p=91 2. Students reflect on the instructional videos	2	0	2
April 10	TPACK Teaching Practice and Reflection in Primary School Chinese (4) 1. Watch the teaching video: Wonderful Imagination (Teacher Chao, Writing) https://www.bilibili.com/video/ BV1tZ4y1K7G7/?spm_id_from=333.337.search-card.all.click 2. Students reflect on the instructional videos	2	0	2

Teaching content and schedule plan (Continued)

Date	Name	Class	Among	
			theory class	practice class
April 11	TPACK Teaching Practice and Reflection in Primary School Chinese (5) 1. Watch the teaching video: "We Are Friends" (Teacher Wang, Oral communication) https://www.bilibili.com/video/ BV1VJ411g7TA?p=112 2. Students reflect on the instructional videos	2	0	2
April 12	TPACK Teaching Practice and Reflection in Primary School Chinese (6) 1. Watch the teaching view, frequency: Chinese Garden four (Teacher Jiang, Comprehensive learning) https://www.bilibili.com/video/BV1VJ411g7TA?p=116 2. Students reflect on the instructional videos	2	0	2
Total		48	25	23

Lesson Plan 1

Teaching content	Acquisition, processing and processing of teaching resources	Teaching form	Online teaching
Teaching time	March 12, 2024 at 20:00 PM-21:30 PM	Class hour	Theory 1 Class hour Practice 1 Class hour
Teaching objectives	1. Understand the concept and classification of teaching resources. 2. Study the basic methods of acquiring, processing and dealing with teaching resources. 3. Learn to acquire, process and process teaching resources through practical operation.		
Teaching points	The concept and classification of teaching resources, the acquisition methods and methods of teaching resources, the processing and processing skills of teaching resources.		
Difficult point	The screening and evaluation of teaching resources, and the application of diversified teaching resources		
Teaching method	Discussion method, demonstration method, case analysis method, group cooperation method		
Teaching content and process design	**Theory class** 1. The importance of introducing teaching resources to stimulate students' interest in the topic.(5 Minutes) 2. Concept and classification of teaching resources (10 minutes) (1) Explain the definition of teaching resources. (2) Introduce the classification of teaching resources, such as books, network resources, multimedia materials, etc. 3. Ways and methods to obtain teaching resources (15 minutes) Discuss the use method of library, Internet, database and other ways. 4. Processing and processing of teaching resources (15 minutes) Introduce how to organize, edit and process the obtained teaching resources to better adapt to the teaching needs. **Practice class** 1. Group task (5 minutes) Students were divided into groups and each group was assigned a teaching topic, requiring them to acquire, process and process corresponding teaching resources through different channels. 2. Practical operation (15 minutes)		

Lesson Plan 1 (Continued)

Teaching content and process design	Students acquire, process and process teaching resources in the group. 3. Group presentation and discussion (17 minutes / group) Two groups were randomly selected to show their operation process and results for discussion and feedback among students. 4. Summary (3 minutes) Teachers will summarize the acquisition, processing and treatment of students' teaching resources and put forward suggestions for improvement.
Homework	Students should review independently to consolidate the knowledge they have learned in this lesson.

Lesson Plan 2

Teaching content	Pinyin, Recognizing Chinese Characters and Writing Chinese Characters	Teaching form	Online teaching
Teaching time	March 14,2024 at 20:00 PM-21:30 PM	Class hour	Theory 2 Class hours
Teaching objectives	1. Review the basic rules of pinyin pronunciation and literate writing. 2. Teacher internship studentsshould understand their common problems in pinyin pronunciation and improve the accuracy of pinyin spelling. 3. Teacher internship studentsunderstand their common problems in literacy and Chinese character writing, and master the literacy skills and the norms of writing Chinese characters.		
Teaching points	1. The pronunciation accuracy of voice mothers and finals, with special attention to easily confused sounds. 2. The specification of the writing of Chinese characters, especially the stroke order and structure of common Chinese characters.		
Difficult point	1. Normal university students' problems in pronunciation. 2. Polyphonic characters, similar characters and similar pronunciation characters.		
Teaching method	Discussion method. conversation method		
Teaching content and process design	Class 1: Pinyin pronunciation and spelling 1. The importance of pinyin for primary school students.(5 Minutes) 2. Question: What problems do you usually encounter in pinyin pronunciation and spelling?shared experience.(5 Minutes) 3. Analysis of pinyin pronunciation problems (10 minutes) (1) Explain the pronunciation. (2) Analyze the common pronunciation problems of trainee teachers, such as soft pronunciation, the distinction between turbidity and clear, etc. 4. Pinyin practice and feedback (10 minutes) (1) Distribute pinyin exercise books for targeted exercises, focusing on common problems. (2) Interns check each other's pronunciation, interact with teachers and students, and correct pronunciation errors in time.		

Lesson Plan 2 (Continued)

Teaching content and process design	5. Group discussion and summary (10 minutes) Group discussion, randomly selected two groups to share pinyin learning experience, summarize the way to solve pronunciation problems. Teacher comments, summarize the pinyin pronunciation notes. **Class 2: Chinese character writing norms and common mistakes** 1. Display some typical Chinese character writing problems, which will arouse the normal university students' attention to their own writing problems. Q: What problems do you usually encounter in writing Chinese characters?(5 Minutes) 2. Analyze the problems and reflect on them.(10 Minutes) (1) Analyze the questions raised by normal university students, focusing on the common brush order errors, typos and the reasons for ugly writing. (2) By comparing the correct and wrong writing samples, the teacher internship students can realize the seriousness of the problem. 3. Explanation and Demonstration of Chinese character writing standard (8 minutes) (1) Introduce some common writing norms of Chinese characters, including horizontal and vertical, dot painting order, etc. (2) Through the projector or whiteboard, demonstrate the correct writing method, pay attention to the coherence and overall structure of strokes. 4. Practice and error correction (7 minutes) (1) Distribute Chinese character exercise books, so that teacher internship students can personally experience the process of writing Chinese characters. (2) Check the students' practice process, correct mistakes in time, and answer doubts. 5. Group discussion and sharing (10 minutes) Divide the practice teachers into groups, let them communicate and discuss with each other, share their experiences and improvement methods. The teacher summarized and guided the group to put forward specific suggestions to solve the writing problem and form a consensus.
Homework	Write an article on pinyin, recognizing Chinese Characters and writing Chinese Characters learning harvest, no word limit.

Lesson Plan 3

Teaching content	PPT Courseware design and beautification	Teaching form	Online teaching
Teaching time	March 15,2024 at 20:00-21:30 PM	Class hour	Theory 1 Class hour Practice 1 Class hour
Teaching objectives	1. Understand the basic principles and beautification points of PPT courseware design. 2. Study the reasonable collocation and typesetting methods of text, pictures, charts and other elements in PPT. 3. Understand the basic principles of color collocation, and improve the ability of controlling the overall visual effect of PPT.		
Teaching points	1. Basic principles of PPT design. 2. Reasonable collocation and typesetting of text, pictures and charts. 3. The basic principles of color matching.		
Difficult point	1. How to achieve prominent information focus and visual attraction in PPT. 2. How to choose and use the appropriate style and color.		
Teaching method	Discussion method, demonstration method, case analysis method, group cooperation method		
Teaching content and process design	1. In theory class 1. Talk about the importance of PPT design and the impact of good design on information transmission.(5 Minutes) 2. Example seven common problems of PPT production.(10 Minutes) Abuse of template, text redundancy, different styles, logic confusion, incorrect text, multiple blind movement, improper color matching 3.PPT Design Basic Principles (15 minutes) (1) Explain the basic principles of comparison, alignment, repetition and emphasis in PPT design. (2) Show the cases to let the students understand the practical application of these principles.		

Lesson Plan 3 (Continued)

Teaching content and process design	4.PPT beautification (10 minutes) (1) Element collocation (2) Color collocation (3) Typography 2. Practice class 1. Group design task (5 minutes) Divide the students into groups, and each group makes 1 Class hour PPT of primary school Chinese to explain the task requirements and goals. 2. Actual design (20 minutes) Students conduct the PPT design in the group and apply the knowledge they learned in the last class. 3. Group presentation and discussion (15 minutes) Two groups were randomly selected to show their design and conduct discussion and feedback. Teacher comments.
Homework	Watch the MOOC national quality course of China University: East China Normal University "Information Teaching Design" [Technology] The collision of multimedia Technology and art, course teachers: Yan Hanbing, Du Longhui, Zhao Na. https://www.icourse163.org/learn/ECNU-1002142003?Tid=1467038505#/learn/content?type=detail&id=1256123437&cid=1288859254&contentid=1215114649

Lesson Plan 4

<table>
<tr><td>Teaching content</td><td>Common Teaching methods</td><td>Teaching form</td><td>Online teaching</td></tr>
<tr><td rowspan="2">Teaching time</td><td rowspan="2">March 18,2024 at 20:00 PM-21:30 PM</td><td rowspan="2">Class hour</td><td>Theory 1 Class hour</td></tr>
<tr><td>Practice 1 Class hour</td></tr>
<tr><td>Teaching objectives</td><td colspan="3">1. Review the common Teaching methods in primary schools.
2. Practice teachers should master how to choose appropriate methods according to different teaching objectives.
3. Practice teachers can flexibly use a variety of strategies in practical teaching to improve the teaching effect.</td></tr>
<tr><td>Teaching points</td><td colspan="3">Understand the concepts, classifications, and applications of common Teaching methods</td></tr>
<tr><td>Difficult point</td><td colspan="3">Flexible use of a variety of methods to design teaching activities</td></tr>
<tr><td>Teaching method</td><td colspan="3">Discussion method, cooperative inquiry method</td></tr>
<tr><td>Teaching content and process design</td><td colspan="3">Theory Class:
1. Review the concept of Teaching method (2 minutes)
Teaching methods are a set of behaviors to achieve the teaching objectives, and the use of Teaching methods, where teachers and students guided by the teaching principles interact around the teaching content.
2. Review the definition and type of Teaching method and their matters needing attention in teaching application (6 minutes)
Teaching method refers to the Teaching method in which teachers use coherent language to teach students systematic scientific and cultural knowledge, improve students' ideological understanding, and develop their intelligence and ability. It is divided into four types: telling, explanation, speaking and speaking. When applying, we should pay attention to the scientific and ideological nature of the teaching; pay attention to the inspiration of teaching; pay attention to the time of teaching; pay attention to the language art of teaching.</td></tr>
</table>

Lesson Plan 4 (Continued)

Teaching content and process design	3. Review the definition, function, form of the conversation method and the matters needing attention in the teaching application (6 minutes) The conversation method is a method that enables students to acquire or consolidate knowledge through the process of asking and answering between teachers and students. According to different conversation purposes, it can be divided into review conversation, enlightening conversation, summative conversation and research conversation. When using the conversation method, we should pay attention to the design of good questions, and the choice of good question object, and the teacher should answer properly. 4. Review the definition, function and application of the reading guidance method (6 minutes) Reading guidance method refers to the method that teachers teach students to read, the process of guiding students to read, so that students develop good reading habits and independent learning ability. Reading instruction method can cultivate students 'good reading habits, cultivate students' self-study ability, reading ability and independent thinking ability; and also can make up for the deficiency of teachers' explanation. 5. Review the definition and function of the discussion method and the matters needing attention in the teaching application (6 minutes) Discussion method refers to the method in which students express their opinions and debate on some issues according to the requirements of teachers under the guidance of teaching requirements, and argue the truth and falsehood, so as to improve their understanding or clarify the problem. Its function is to cultivate students' thinking ability, research ability, language expression ability and organizational management ability. The problems that should be paid attention to by using the discussion method include doing the preparation work before the discussion, guiding the discussion process well, and making a summary work after the discussion. 6. Review the definition, type, function of the demonstration method and the matters needing attention in the teaching application (6 minutes) Demonstration method refers to the teacher cooperating with the teaching and conversation, through displaying intuitive teaching AIDS or using modern teaching means, to obtain the methods of knowledge, including "physical intuition", "model intuition" and "language intuition", can help students to obtain intuitive perceptual

Lesson Plan 4 (Continued)

Teaching content and process design	understanding, shorten the distance between theory and practice, stimulate the interest in learning, and do a good preparation before demonstration, guide the demonstration process, and help students to improve their understanding. 7. Review the selection and application of Teaching methods (8 minutes) In teaching, we generally choose different Teaching methods according to the different teaching objectives and tasks, the characteristics of teaching content, learners 'learning situation, teachers' own characteristics, the characteristics of Teaching methods themselves, teaching conditions and so on. The application of Teaching methods should follow the principles of integrity, development, comprehensiveness, flexibility and inspiration. **Practice Class:** 1. Group cooperation to design a primary school Chinese teaching segment (no more than 8 minutes), teaching activities should reflect the teaching strategy.(20 Minutes) 2. Group sharing and discussion (20 minutes) (1) Randomly select 2 groups to show the teaching fragments of the design. (2) Teachers guide students to sum up their experience and put forward suggestions for improvement.
Homework	1. Watch the MOOC of Chinese University: "Teaching Theory" Chapter 6 Teaching methods, teachers: Wang Benlu, Wang Yonghong, Pan Xinmin. https://www.icourse163.org/learn/BNU-1002012029?tid=1002113022#/learn/content?type=detail&id=1004063550 2. Write a 1-Class hour primary school Chinese teaching plan, requirements: use more than three Teaching methods.

Lesson Plan 5

Teaching content	Modern Chinese grammar	Teaching form	Online teaching
Teaching time	March 19,2024 at 20:00 PM-21:30 PM	Class hour	Theory 2 Class hours
Teaching objectives	1. Practice teachers should understand the basic concepts and systems of modern Chinese grammar. 2. Practice teachers should master the common grammar knowledge in primary school Chinese teaching. 3. Practice teachers can guide students to correctly use the basic grammatical structure in teaching.		
Teaching points	Understand the basic concepts and systems of Chinese grammar and the application of grammar in primary school Chinese teaching		
Difficult point	The application of grammar knowledge in primary school Chinese teaching		
Teaching method	Discussion method, conversation method, cooperative learning method		
Teaching content and process design	1. Basic concepts of Chinese grammar (4 minutes) (1) Explain the definition, basic function and research objects of the grammar. (2) Emphasize the importance of grammar in Chinese subjects. 2. Classification and system of grammar (18 minutes) (1) Syntax: Introducing the basic structure and components of a sentence. (2) Lexology: explain the construction and classification of words. (3) Grammatical system: integrate syntax and grammar into the overall grammatical system, emphasizing their mutual relationship. 3. Common grammar knowledge points (18 minutes) (1) Timing and voice: explain the expression of tense and voice in Chinese. (2) Subject-predicate-object structure: emphasizes the basic composition of the sentence. (3) Modification components: introduce adjectives, adverbs, attributives, adverbials, etc.		

Lesson Plan 5 (Continued)

Teaching content and process design	4. Grammar application in Primary school Chinese teaching (10 minutes) (1) According to the language characteristics of primary school students, introduce how to flexibly use grammar knowledge. (2) Analyze the common difficult points in grammar learning. 5. Teaching activity design (10 minutes) Practice teachers should design a primary school Chinese teaching segment (no more than 8 minutes), which should contain different types of grammatical knowledge points, emphasizing interaction and practical application. 6. Group sharing and discussion (20 minutes) (1) Randomly select 2 groups to show the teaching fragments of the design. (2) Teachers guide students to sum up their experience and emphasize the application of grammar knowledge in practical teaching.
Homework	Watch the MOOC National Excellent course of Chinese University: "Modern Chinese Grammar and Rhetoric" first to the 11th course teachers: Zhang Yichun, Li Yao, Chen Guohua, Qin Liang, Jiang Li.https://www.icourse 163.org/learn/YCTC-1207453802?tid=1471067530#/learn/content?type=detail&id=1255722868&sm=1

Lesson Plan 6

<table>
<tr><td>Teaching content</td><td>Introduction and application of primary school Chinese related APP functions</td><td>Teaching form</td><td>Online teaching</td></tr>
<tr><td rowspan="2">Teaching time</td><td rowspan="2">March 20,2024 at 20:00-21:30 PM</td><td rowspan="2">Class hour</td><td>Theory 1 Class hour</td></tr>
<tr><td>Practice 1 Class hour</td></tr>
<tr><td>Teaching objectives</td><td colspan="3">1. Practice teachers understand the functions and characteristics of Chinese-related APP in primary schools.
2. Internship teachers can choose a suitable APP to carry out auxiliary teaching.</td></tr>
<tr><td>Teaching points</td><td colspan="3">Functions and characteristics of APP related to primary school Chinese teaching</td></tr>
<tr><td>Difficult point</td><td colspan="3">Design and organize the teaching activities related to the APP</td></tr>
<tr><td>Teaching method</td><td colspan="3">Case analysis method, demonstration method, discussion method, cooperative inquiry method</td></tr>
<tr><td>Teaching content and process design</td><td colspan="3">Theory Class:
1. Introduce the role of APP related to Chinese teaching in primary schools (10 minutes)
(1) Assist students in learning: to provide interesting and vivid learning content, through multimedia means such as text, audio, video, etc., to stimulate students' interest in learning, enhance memory.
(2) Provide personalized learning: Through intelligent algorithms, provide personalized learning recommendations and exercises according to students' learning habits, levels and needs, to help students better master knowledge.
(3) Enhance the interactivity of teaching: provide an interactive learning environment, including games, tests, online discussions, etc., to make learning more vivid and interesting, and stimulate students' enthusiasm in learning.
(4) Rich extracurricular teaching resources: provide development materials related to classroom teaching, such as poetry appreciation, literary classics reading, etc., to help students deeply understand and expand the scope of knowledge.
(5) Real-time feedback of students 'learning situation: it can timely feedback students' learning progress, weaknesses and advantages, help teachers and</td></tr>
</table>

Lesson Plan 6 (Continued)

Teaching content and process design	parents to better understand students' learning situation, and adopt targeted teaching strategies. 2. Introduce to students the primary school Chinese related APP and features that are popular with primary school Chinese teachers and their characteristics (15 minutes) Word category APP: Wukong Pinyin, Wukong Literacy, Xinhua Dictionary Heard that the class APP: Litchi Radio Station (Litchi FM) Reading APP: mind map, Douban Writing APP: primary school composition, brief book Comprehensive APP: Nanobox 3. Precautions in using the APP related to Chinese teaching (15 minutes) (1) Consistent with the teaching objectives: to ensure that the selected APP is consistent with the Chinese teaching objectives, which can effectively support the learning of subject knowledge and improve the Chinese literacy. Can't just for use. (2) Personalized matching: Provide personalized teaching, and provide corresponding content according to students' level and interests. (3) Interactivity and fun: have interaction and fun, stimulate students' interest in learning, and make learning lively and interesting. (4) Security and privacy: to ensure the security of the APP, protect students' privacy, and comply with regulations and ethical norms. (5) Timely feedback: provide timely learning feedback, help to understand students' progress and adjust teaching strategies. (6) Time management: arrange the use time reasonably to avoid excessive addiction to electronic devices. **Practice Class** 1. Teacher internship students choose to download, install and register primary school Chinese related APP.(5 Minutes) 2. Group cooperation, design a segment of primary school Chinese teaching activities (no more than 8 minutes), and the teaching activities should reflect the application of the APP.(15 Minutes) 3. Group sharing and discussion (20 minutes) (1) Two groups were randomly selected to show the designed teaching activities and share their experience of using the APP. (2) Teachers guide students to sum up their experience and put forward suggestions for improvement.

Lesson Plan 6 (Continued)

Homework	1.Watch the MOOC national quality courses of China University online: East China Normal University "Information Teaching Design" [Technology] Subject optimization tools, hardcore new weapons seventh Chinese teaching APP, course teachers: Yan Hanbing, Du Longhui, ZhaoNa.https://www.icourse163.org/learn/ECNU-1002142003?Tid=1467038505#/learn/content?type=detail&id=1247787307&cid=1273962672&replay=true 2. Write an APP to integrate into primary school Chinese teaching experience (not limited).

Lesson Plan 7

<table>
<tr><td>Teaching content</td><td>Instructional design</td><td>Teaching form</td><td>Online teaching</td></tr>
<tr><td rowspan="2">Teaching time</td><td rowspan="2">March 21,2024 at 20:00-21:30 PM</td><td rowspan="2">Class hour</td><td>Theory 1 Class hour</td></tr>
<tr><td>Practice 1 Class hour</td></tr>
<tr><td>Teaching objectives</td><td colspan="3">1. Review the pedagogy theory and teaching design related knowledge learned by normal university students.
2. Strengthen the theoretical knowledge, so that the trainee teachers can more confidently apply it to the practical teaching design.</td></tr>
<tr><td>Teaching points</td><td colspan="3">The theory, typical model and important link of teaching design</td></tr>
<tr><td>Difficult point</td><td colspan="3">the combination of teaching design theory and practice</td></tr>
<tr><td>Teaching method</td><td colspan="3">Discussion method, case analysis and group cooperation</td></tr>
<tr><td>Teaching content and process design</td><td colspan="3">Theory class
1. Guide students to review the knowledge of teaching design they have learned in college, and ask questions to stimulate their thinking.(2 Minutes)
2. Review of teaching design theory.(15 Minutes)
(1) Review the basic concepts, models and principles of teaching design, such as ADDIE model, Bloom's cognitive goal classification, etc.
(2) Analyze the cases, and let the students use the theoretical knowledge to solve the practical teaching design problems.
3. Several important links of instructional design.(20 Minutes)
(1) Design of teaching tasks
(2) Design of teaching objectives
(3) The design of the teaching structure
(4) Design of homework
4. Strengthen key knowledge.(3 Minutes)
For students easy to confuse or forget the knowledge points, strengthen the explanation and questions.</td></tr>
</table>

Lesson Plan 7 (Continued)

Teaching content and process design	**Practice Class** 1. Practice of teaching design (20 minutes): Will the students divided into several groups, ask each group according to the teaching design theoretical knowledge, a third grade Chinese class, teaching design practice, article selection. 2. Group sharing and summary (15 minutes): Two groups were randomly selected to show the teaching design and share their experience and problems in practice. 3. Teachers should make comments and emphasize the close connection between theory and practice.(5 Minutes)
Learning materials	Watch the MOOC national quality course of Chinese University: "Mastering Teaching Design" of Zhejiang University online. Teachers: Sheng Qunli, Liu Hui, Feng Jianchao, Direction.https://www.icourse163.org/learn/icourse-1003595004?tid=1003819006#/learn/content?type=detail&id=1210936498&cid=1213416193

Lesson Plan 8

Teaching content	Common sense of literature	Teaching form	Online teaching
Teaching time	March 22,2024 at 20:00-21:30 PM	Class hour	Theory 2 Class hours
Teaching objectives	1.Rreview and accumulate literary knowledge with various methods. 2. Through a period of review and accumulation, I am familiar with the important writers and works involved in primary school Chinese textbooks, and understand the main cultural knowledge explained in primary school Chinese textbooks.		
Teaching points	The connotation and accumulation method of literary common sense		
Difficult point	Accumulate rich literary common sense		
Teaching method	Discussion, reading guidance, cooperative learning method		
Teaching content and process design	1. The importance of literature knowledge for primary school Chinese teachers.(5 Minutes) 2. The connotation of literary common sense.(20 Minutes) (1) Literary history: the history of literature, one of the achievements of human culture, and the historical phenomenon and development law of literature. (2) Literary schools: refers to the literary groups and factions formed by a group of writers in the development of literature in a certain period of history, usually with a certain aesthetic view and a certain number and representative characters. (3) Important writers: refers to the writers who choose their works involved in the Chinese textbooks of primary, middle and senior high schools or the first-class writers introduced in the unit knowledge essays and textbook notes. (4) Important works: some important, classic and representative works in the field of literature.		

Lesson Plan 8 (Continued)

Teaching content and process design	(5) Literary analysis: a method for in-depth research and interpretation of literary works. Through an in-depth analysis of the language, structure, theme, image and other aspects of the literary works, the literary analysis aims to understand the inner meaning of the works and the creative intention of the author. 3. The method of accumulating literary common knowledge.(20 Minutes) (1) Combine the old law with the new: combine the new knowledge with the learned knowledge. (2) The point with the surface method: take the works of a certain family as the "point", and then expand from this "point" to the "surface" of all the works of the famous artist selected in the textbook. (3) Vertical extension method: that is, to comb and remember literary common knowledge from the longitudinal perspective. (4) Horizontal comparison method: collect the literary common knowledge of the same attribute together, find out their similarities and differences, and combine them according to their similarities and differences, so as to achieve "text" together. 4. Self-study: Literature knowledge (20 minutes) https://baijiahao.baidu.com/s?id=1658757685548041446&wfr=spider&for=pc https://baijiahao.baidu.com/s?id=1637499159406756776&wfr=spider&for=pc 5. Students test each other for literary knowledge.(10 Minutes) 6. Teacher summary.(5 Minutes) Read more and remember more, the knowledge point of literary common knowledge is systematic, organized.
Homework	In the daily study, accumulate literary common knowledge.

Lesson Plan 9

<table>
<tr><td>Teaching content</td><td>Teaching evaluation</td><td>Teaching form</td><td>Online teaching</td></tr>
<tr><td rowspan="2">Teaching time</td><td rowspan="2">April 3,2024 at 20:00 PM-21:30 PM</td><td rowspan="2">Class hour</td><td>Theory 1 Class hour</td></tr>
<tr><td>Practice 1 Class hour</td></tr>
<tr><td>Teaching objectives</td><td colspan="3">1. Review the theoretical knowledge of teaching evaluation already learned by the practice teachers.
2. Strengthen the theoretical knowledge, so that the students can carry out the effective teaching evaluation more confidently.</td></tr>
<tr><td>Teaching points</td><td colspan="3">Teaching evaluation theory, evaluation tools and methods</td></tr>
<tr><td>Difficult point</td><td colspan="3">The combination of teaching evaluation theory and practice</td></tr>
<tr><td>Teaching method</td><td colspan="3">Discussion, case analysis and group cooperation</td></tr>
<tr><td>Teaching content and process design</td><td colspan="3">Theory class
1. Basic concept review (10 minutes)
(1) Review the basic concepts of teaching evaluation, including the definition, type and purpose of evaluation.
(2) Highlight the importance of teaching evaluation in education.
2. Review of teaching evaluation theory (20 minutes)
(1) Review common teaching evaluation theories, such as the four-level evaluation model of Kirkpatrick and Stephanni, and the standard reference evaluation of Scriven, etc.
(2) To analyze the advantages and applicable scenarios of each theory.
3. Evaluation tools and methods (10 minutes)
Some common evaluation tools and methods, such as questionnaire survey, observation, oral feedback, etc.
Practice Class
1. Practice of teaching evaluation.(20 Minutes)
The students are divided into several groups, and each group is required to</td></tr>
</table>

Lesson Plan 9 (Continued)

	evaluate the teaching video according to the teaching evaluation theoretical knowledge, and the content is self-selected. 2. Group sharing and summary.(15 Minutes) Two groups were randomly selected to show the teaching evaluation and share their experience and problems in practice. 3. Teachers should make comments and emphasize the close connection between theory and practice.(5 Minutes)
Learning materials	Watch the MOOC course of Chinese University online: "Teaching and Evaluation of College Smart Classroom" of Zhejiang University, course teachers: Li Yan, Guo Yuqing, Su Jianyuan, Ouyang Fan, Geng Fengji, https: //www.icourse163.org/learn/ZJU-1207107825?tid=1207479216#/learn/content

Appendix E

Certificate of English

BANSOMDEJCHAOPRAYA
RAJABHAT UNIVERSITY

This is to certify that

Miss Fang Fang

Achieved BSRU English Proficiency Test (BSRU-TEP) level

C1

Given on 12th February 2022

(Assistant Professor Dr Kulsirin Aphiratvoradej)

Director

Appendix F

The Document for Acceptance Research

Interdisciplinary Academic and Research Journal ISSN 2985-2749 (Online)
DR.KEN Institute of Academic Development and Promotion.
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Mahasarakham Province, Thailand, 44000 Tel: +66946398978.
Website: https://so03.tci-thaijo.org/index.php/IARJ/about

ที่ วสวว. 116/2567 6 เมษายน 2567

เรื่อง ตอบรับการตีพิมพ์เผยแพร่ใน Interdisciplinary Academic and Research Journal

เรียน **Fang Fang, Nainapas Injoungjirakit, Sombat Teekasap**

ตามที่ท่านได้ส่งบทความ เรื่อง **TPACK Ability Test for Associate Degree Teacher Internship Students in Primary School Chinese** เพื่อลงตีพิมพ์ใน **Interdisciplinary Academic and Research Journal (Online), Old ISSN 2774-0374 (Online) : New ISSN 2985-2749 (Online) indexed by Thailand Citation Index (TCI) กลุ่ม 2,** DataCite-International Data Citation, **DOI CrossRef Member และ ResearchGate** กองบรรณาธิการได้ดำเนินการตามกระบวนการการพิจารณาบทความโดยเสนอบทความต่อกรรมการกลั่นกรองบทความ (Peer Review) พิจารณาตรวจแก้ไขเพื่อความสมบูรณ์ของบทความก่อนการลงตีพิมพ์

กองบรรณาธิการขอแจ้งให้ท่านทราบว่าบทความที่ท่านได้ผ่านการพิจารณาจากผู้ทรงคุณวุฒิ (Peer Reviewer) จำนวน 3 ท่าน เรียบร้อยแล้ว และอยู่ในขั้นตอนการตีพิมพ์ใน Interdisciplinary Academic and Research Journal ปีที่ 4 ฉบับที่ 4 ประจำเดือน กรกฎาคม-สิงหาคม พ.ศ.2567 ติดตามบทความได้ที่ https://so03.tci-thaijo.org/index.php/IARJ/about

ขอขอบคุณที่ท่านส่งบทความมาเพื่อเผยแพร่ กองบรรณาธิการหวังเป็นอย่างยิ่งว่าจะได้รับบทความที่น่าสนใจและเป็นประโยชน์จากท่านเพื่อนำลงตีพิมพ์ในวารสารฯ ฉบับต่อไปเช่นเคย

จึงเรียนมาเพื่อโปรดทราบ

ขอแสดงความนับถือ

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