



TPACK Ability Test for Junior College Teacher Internship Students in Primary School Chinese

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Abstract

Background and Aims: TPACK (Technological Pedagogical and Content Knowledge) is an essential ability for teachers in the digital era that has a high effect on the quality of basic education. In this paper, 55 junior college teacher education students in the class of 2021, majoring in elementary education as teacher education students in Guangxi, were measured at the beginning of their educational internships to understand their level of TPACK.

Methodology: Using a homemade TPACK measurement tool, a test paper, which experts had evaluated. Research results indicate that the scores in the seven dimensions of TK, PK, CK, TPK, TCK, PCK, and TPCK range from 30.5% to 61%, among which TPK was the highest and TK was the lowest. Overall, the TPACK ability was at a low level.

Results: Results showed that the TPACK test results of teacher education students of primary school Chinese will provide an important basis for formulating TPACK improvement strategies in the internship stage.

Conclusion: The results show that measuring TPACK competency in Chinese teacher education students in elementary schools is an essential first step toward developing focused tactics to improve TPACK in the internship stage. This realization emphasizes how important it is to match educational interventions to particular skill development requirements to maximize teaching efficacy in elementary school environments.

Keywords: Primary School Chinese Teaching; Junior College Teacher Internship Students; TPACK Ability Test





Introduction

Integration of information technology and education is an important task of the current education reform. Since the 21st century, the Chinese government has formulated a series of important documents such as the Ten-Year Development Plan for Education Informatization (2011-2020) and actively promoted the innovative development of the integration of information technology and education. How to effectively achieve the integration of technology and education is the key to improving the quality of information teaching (Ren,2015). Therefore, the TPACK framework, which integrates technology, pedagogy, and content knowledge, has received widespread attention from academic communities since proposed in 2005. More and more scholars believe that TPACK is an essential ability for teachers (Chen,2015), and effectively improving teachers' TPACK ability is an important component of the education informatization process (Zhang et al., 2015). Teacher education students, as the reserve force of future teachers, their information teaching ability will directly affect the future education quality (Ren et al.,2018) and should be oriented by TPACK ability cultivation in the pre-service stage and promote their professional growth. Teachers' ability to teach with information technology is becoming increasingly important, so we must pay attention to the cultivation of teacher education students' TPACK skills.

Objectives

Understanding the TPACK ability of teacher internship students is the premise for promoting their ability improvement

Literature Review

1. TPACK

Mishra and Koehler of Michigan State University (USA) formally proposed the integration of technical knowledge into subject teaching knowledge based on the concept of PCK (pedagogical knowledge) advocated by Shulman (1986). The concept of TPCK (Technological Pedagogical Content Knowledge) was formed in 2005. In 2006, after extensive consultation by the AACTE Innovation and Technology Committee, "TPCK" was changed to "TPACK" (Technological Pedagogical and Content Knowledge), for easier to pronounce, remember, and maintain the original concept. TPACK is an integration of technology, teaching methods, and subject knowledge, and specifically includes seven dimensions, namely, three basic dimensions of TK, PK, and CK and four integrated dimensions of TPK, TCK, PCK, and TPACK



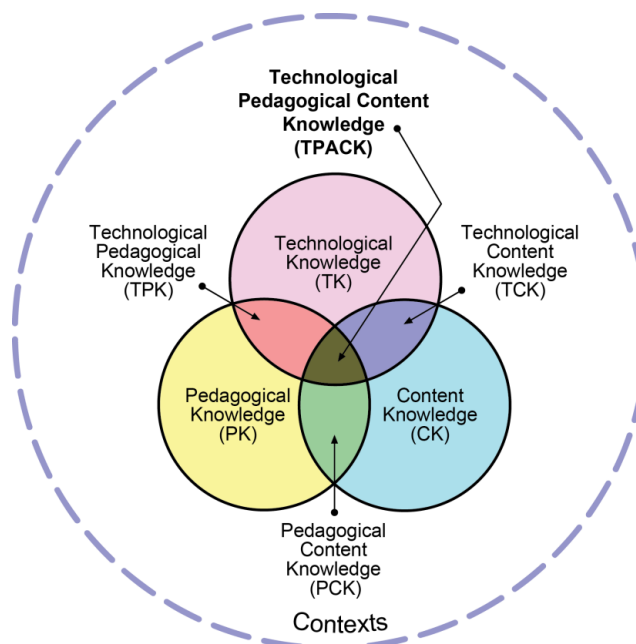


Figure 1 Schematic diagram of TPACK framework components (Mishra & Koehler, 2006)

Since the TPACK concept was proposed in 2005, scholars have achieved fruitful results in its research. Through sorting out and summarizing the literature, it was found that the research mainly focuses on three major aspects: First, the conceptual connotation, theoretical model, and measurement tools of TPACK. The second is research on existing problems, influencing factors, and development strategies of TPACK. The third is research on the application of TPACK in different disciplines and different educational stages. Judging from the timeline of TPACK research, before 2010, the concept was mainly proposed and applied in teacher education projects, and its conceptual framework was further interpreted, clarified, and even developed; after 2010, the research on TPACK for teacher education students' Characteristics, developmental methods, and measurement methods have begun to receive attention and are increasingly used in teacher education programs and teacher education students training processes.

2. Related research on the TPACK ability test for teacher education students

At present, the most used method to measure TPACK is the questionnaire method. Others include performance evaluation methods, classroom observation methods, interview methods, combined open-ended questionnaires, and other qualitative measurement methods. Several measuring TPACK ability methods are often combined. Since the research tool of this study is a test paper, which is more like a questionnaire in nature, this study will use the TPACK test method in recent high-quality journal papers and master's theses in China as a questionnaire survey method and the research object is teacher education students.



The paper is analyzed as an object, aiming to create effective test papers through literature analysis and to gain a certain understanding of the TPACK ability commonly displayed by teacher education students in general.

After combing through the literature, it was found that most of the research tools used by Chinese scholars in the study of TPACK ability measurement of teacher education students or teacher internship students are based on the questionnaires of 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, 2023; Tiansoodeenon et al., 2023). Chinese teacher education students have many problems whether it is the single knowledge TK, CK, and PK of the TPACK combination or the composite knowledge PCK, TCK, TPK, and TPCK, and their overall level needs to be improved, especially TK, CK, and PK (Qin, 2022); teacher education students 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 capabilities and cannot achieve effective integration of artificial intelligence and other technologies with education and teaching (Ma, Li, & Yu, 2023).

Table 1 Dimensions and question statistics of teacher education students' TPACK measurement carried out using questionnaire surveys in recent years.

Author	Establishment basis	Dimension	No. of question	TK	PK	CK	TPK	TCK	PCK	TPCK
Huang, X.	Archambault scales, Crippen scales	7	21	US	US	US	US	US	US	US
Zhang, T.	Schmidt scales	7	27	US	US	US	US	US	US	US
Wang, C.	Schmidt scales, Archambault scales	7	26	US	US	US	US	US	US	US
Cui, J.	Schmidt scales,	7	33	7	7	3	5	3	3	5





Author	Establishment basis	Dimension	No. of question	TK	PK	CK	TPK	TCK	PCK	TPCK
	Zhan Yi scales, Zhang Zhe scales									
Gao, J.	Chai scales	7	42	9	6	4	5	4	8	6
Qin, C.	Multiple scales	7	31	US	US	US	US	US	US	US
Hou, X.	Schmidt scales, Archambault scales, Chai scales	7	36	7	6	3	5	4	5	6
Yu, M.	Schmidt scales, Archambault Scales, Graham scales	7	33	6	7	3	5	3	3	6
Duan, Y.	Multiple scales	7	42	9	6	4	6	4	8	5

Note: US refers to unspecified.

From a comprehensive literature research, it was found that:

(1) Information-based teaching ability is an important ability that contemporary teachers must possess, and the TPACK framework provides a theoretical basis for teacher education students to better carry out information-based teaching.

(2) 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.

(3) Although many studies combine TPACK with disciplines in existing research, most of the research focuses on Mathematics, English, Geography, Chemistry, etc., and there are very few research results that combine TPACK with Chinese subjects. Therefore, the author believes that researching the TPACK test for teacher internship students in primary school Chinese is a very meaningful task.



Methodology

A mixed research method was used in this study.

The Population is a class of 55 junior college teacher internship students in elementary education at a Normal university in Guangxi and the whole population as the Sample Group

The instruments were 1) Develop a test paper (including grading criteria) to measure the TPACK ability of teacher education students before the internship. 2) Develop an expert assessment form and ask five experts to evaluate the validity of the test paper (including grading criteria).

The procedure of this study is as follows:

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

2. Clarify the scope of TPACK questions for teacher internship students. The TPACK test questions are related to the three types of courses that teacher education students majoring in elementary education study at the university level: First, modern educational technology courses. The second is a course on teaching methods, and the third is a course 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 TPACK respectively.

3. Ensure the quality of the test questions. To ensure the quality of the test questions, and reflect their representativeness and authority, the researcher determined the types and topics of the test questions from the following two aspects: First, appropriate questions were selected from the final exam questions of more than 20 national quality courses related to modern educational technology, information technology foundation, curriculum and teaching theory, teaching theory, informatized teaching design, primary school Chinese teaching design, college Chinese, etc. on the Chinese University MOOC platform, and the types and content expression methods of the questions were referred to, and the difficulty of the test questions was matched with the level of the students in the researcher's school as much as possible. Second, referring to the Schimdt questionnaire (Schimdt, 2009), Li Beibei's TPACK measurement questionnaire (Li, 2020) for high school Chinese teachers, etc., it was determined that the TPACK measurement of teacher education students was divided into seven dimensions: TK, PK, CK, TPK, PCK, TCK, and TPACK. At the same time, according to the observation dimensions and observation points of Zhuang's "TPACK Classroom Observation Form for Primary School Chinese Teachers" (Zhuang, 2021),





the key points of testing technology in combination with Chinese teaching were further determined.

4. Preliminarily formulate the test paper, which is worth 100 points and has two types of questions: single-choice questions and multiple-choice questions. The scoring rules are points for correct answers, and no points for wrong or no choices.

5. Make an expert assessment form to evaluate the test paper. Experts will determine whether the test questions are consistent with what they have learned in university, 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 test paper, 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.

6. Submit the prepared test paper and the expert assessment form to 5 experts, ask the experts to evaluate the quality of the test questions, and adjust the test paper based on the expert assessment results.

7. Submit the adjusted test papers to 5 experts again and ask the experts to evaluate the quality of the test questions.

8. The experts expressed their approval of the adjusted test paper.

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

Table 2 The basis, dimensions, and question volume statistics of the test paper used in this study.

Establishment basis	Dimensions	Number of questions	TK	PK	CK	TPK	TCK	PCK	TPCK
Schmidt Questionnaire, Li Beibei Questionnaire, Zhuang Jingyin Class Observation Form	7	39	7	7	5	6	6	5	3

Table 3 Evaluation standards for each dimension of the TPACK test for junior college teacher internship students in primary school Chinese.



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
Medium	9-10	9-10	8-9	8-9	8-9	9-10	5
Pass	7-8	7-8	6-7	6-7	6-7	7-8	4
Poor	<7	<7	<6	<6	<6	<7	<4

10. Before the start of the internship, organize all 55 junior college teacher internship students of elementary education to take the TPACK proficiency test.

11. Score the test papers according to the reference answers and scoring rules and tally the test scores.

12. Analyze the TPACK test results of the teacher internship students from the average level of the seven dimensions and the different dimensions.

Data Analysis has been done through (1) Mean score and standard deviation. And (2) The average score and standard deviation of each dimension.

Results

Judging from the overall test results, the TPACK ability of 55 teacher internship students in primary school Chinese is at a low level. The highest score is 66 points, the lowest score is 32 points, the average score is 48.3 points, and the standard deviation is 8.08. From the perspective of each dimension, due to different question sizes and different scores in each dimension, the correct rates after conversion from high to low are: TCK (61.0%) > PK (59.3%) > CK (55.4%) > PCK (46.0%) > TPK (43.1%) > TPCK (41.8%) > TK (30.5%), that is, elementary education junior college students participating in teacher internship programs are the highest on TCK and the lowest on TK. According to the TPACK evaluation standards for teacher internship students in primary school Chinese formulated in this study, the average accuracy rate of each dimension after conversion is between 30.5% and 61%, indicating that the abilities of each dimension are at a low level. The proportion of people whose scores are below the medium level in each dimension are respectively: TK:90.9%, PK:38.2%, CK:40.0%, TPK:74.5%, TCK:30.9%, PCK:67.3%, and TPCK:89.1%

Table 4 TPACK test results for junior college teacher internship students in primary school Chinese.

Dimension	Full score	Highest score	Lowest score	Standard deviation	Average Accuracy	The average accuracy ranking for each dimension
Overall	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
TPACK	8	6	0	1.58	41.8%	2

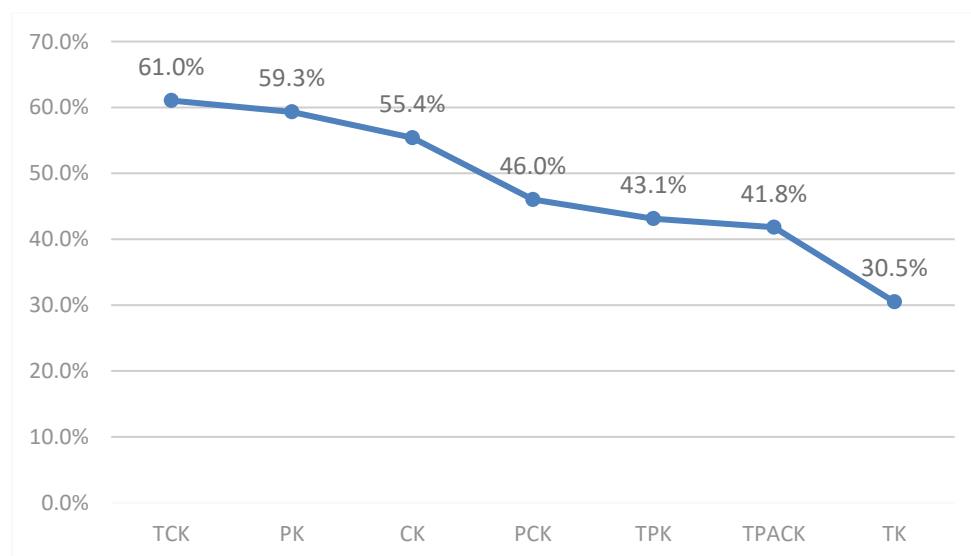


Figure 2 Accuracy rates for each dimension in the TPACK test for junior college teacher internship students



Table 5 Results of various dimensions of the TPACK test for junior college teacher internship students in primary school Chinese

Grade	Frequency						
	TK	PK	CK	TPK	TCK	PCK	TPCK
Excellent	0	4	6	1	11	0	0
Good	1	16	12	4	14	3	6
Medium	4	14	15	9	13	15	0
Pass	10	10	10	25	9	20	30
Poor	40	11	12	16	8	17	19

Discussion and conclusion

1. Average ability of teacher internship students in primary school Chinese TPACK in the seven dimensions is at a low level, and abilities in each dimension are not high. Of the three basic dimensions, the PK dimension has the highest score, followed by the CK dimension, and the TK dimension. It has something to do with the characteristics of primary education majors. The primary school education major is affiliated with the College of Educational Sciences.

For the College 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, Teacher internship students in primary school Chinese 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. There is an urgent need to review and consolidate the basic knowledge of Chinese subjects in the following educational internships.

The reason for the low score in the TK dimension is related to the teacher internship students themselves not paying enough attention to Chinese APPs. The only





information technology-related courses in the university 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 apps. 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. Such APPs have highly targeted learning content and embody 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.

The reason for the lower TPACK ability is also related to the separation of theoretical knowledge and practical experience of teacher internship students. Some of them have good theoretical knowledge, but because of the lack of practical experience in teaching, they do not know how to answer the questions when they encounter highly practical topics during the test. Some of them had rich practical experience but poor theoretical knowledge, so they were also unable to perform well on the test.

2. From the results of this study, the results produced by utilizing the self-administered questionnaire as a research tool are consistent with the results of many studies in China that have been obtained using the questionnaire method. Among them, the results obtained by using the Schmidt scale as a survey instrument were also the highest in TCK and the lowest in TK in a study whose subjects were also associated with degree teacher education students' Chinese TPACK ability (Cao & Yu, 2023).which also shows the validity and reliability of the test paper as a research tool.

3. The most used methods for measuring TPACK are divided into two categories in the world: quantitative measurement and qualitative measurement. Since questionnaire testing methods are highly subjective, qualitative measurement methods such as performance evaluation methods have problems such as complex operations, and 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 teacher education students to the knowledge of every single dimension and integrated dimension of TPACK. It is a relatively objective TPACK measurement method, which effectively reduces the questionnaire classification. 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 method will be more time-saving and labor-saving and is a



research tool worth learning from.

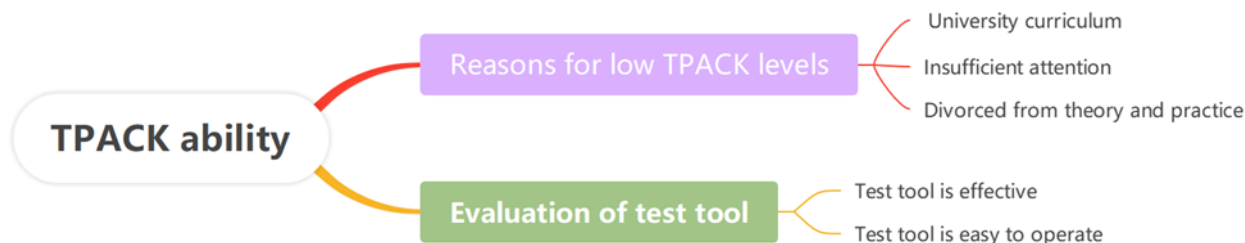


Figure 3 Testing and analyzing the TPACK competencies on teacher education students

Limitations

This study has some limitations that should be noted. Firstly, the samples in this study were relatively small size and only drawn from a Normal university in Guangxi, so It may lack sufficient representativeness, thus, the research findings may not apply to other regions or countries. Secondly, this study focuses solely on teacher internship students in the field of primary school Chinese, so the research results may not apply to teacher internship students in other subjects. Thirdly, there may be some flaws in the homemade question papers, and feedback from the teacher internship students tested on the quality of the question papers will need to be taken in future studies for further improvement.

Recommendations

1. The test paper can effectively test the TPACK competence of teacher internship students, and the results of testing are more objective than the measurements of questionnaires. The testing method is more convenient and efficient compared to the measurement methods such as performance evaluation.

2. The test paper only set objective questions, while TPACK competence is a highly practical competence, especially the TPACK dimension, it is difficult to test the real competence of the teacher internship students in the TPACK dimension only through single or multiple choice questions, subjective questions should be set, such as examining teacher internship student's lesson plan production and other measurements of their competence in the TPACK dimension. However, considering that this is only a study by the researcher and the cooperation of the practicing teachers may not be high, the test can only reluctantly be set up with all multiple-choice questions. If the support of the college can be obtained to incorporate the test results as part of the educational internship grades, it will greatly enhance the importance attached by teacher internship students to the TPACK test. With the



prerequisite of obtaining the support of the college, it is recommended that the test paper should combine objective questions with subjective questions.

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