Academic Education Publishing House

Occupation and Professional Education Vol. 1 No. 1, 2024

Research on the Teaching Knowledge Structure of Preservice Primary School Chinese Language Teachers from the Perspective of Integrating Technology

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Abstract: This study delves into the TPACK knowledge structure of preservice primary school Chinese language teachers, including its theoretical construction, model design, classroom practices, and the influencing factors and configuration strategies. Through a theoretical analysis of the foundation and characteristics of the TPACK knowledge structure framework, quantitative and qualitative methods are employed to measure the structural components and construct a model suitable for primary school Chinese language teaching. It thoroughly analyzes teachers' practices in classroom behavior, teaching media, and TPACK dimensions, and examines the individual, organizational, subject, environmental, and technological differences, proposing targeted configuration strategies. This comprehensive study offers essential insights for the training and support of preservice primary school Chinese language teachers and contributes to advancing educational quality and innovation.

Keywords: TPACK; Preservice Primary School; Chinese Language Teachers; Knowledge Structure

1. Introduction

Preservice primary school Chinese language teachers face an increasingly complex task in integrating technology, teaching content, and teaching methods. The TPACK (Technological, Pedagogical, and Content Knowledge) framework provides a robust theoretical foundation for understanding this integration. This study focuses on the TPACK knowledge structure of preservice primary school Chinese language teachers, exploring its theoretical construction, model design, classroom practices, and configuration strategies. Through an in-depth analysis of these key aspects, the research aims to offer new insights and directions for teacher training and instructional practice. This comprehensive exploration helps enhance the understanding of how to more effectively integrate technology and teaching in primary school Chinese language education in the contemporary educational environment, thereby promoting teaching quality and innovation.

2. Construction of the TPACK Knowledge Structure Framework for Preservice Primary School Chinese Language Teachers

2.1 Theoretical Framework of TPACK Knowledge Structure for Preservice Primary School Chinese Language Teachers

The TPACK knowledge structure framework for preservice primary school Chinese language teachers, encompassing technological, pedagogical, and content knowledge, is a model that combines teaching skills and professional knowledge. In this framework, teachers must not only master the course content but also understand how to convey it to students, effectively utilizing modern educational technology to achieve this aim. The TPACK model emphasizes three core domains that teachers should possess: technological knowledge (TK), content knowledge (CK), and pedagogical knowledge (PK), together forming the teacher's professional competence [1]. It encompasses specific content knowledge of the Chinese subject, as well as the integration of teaching methods and educational technology. This integration enables teachers to profoundly

understand the complexity of Chinese education and the ability to flexibly employ various teaching strategies in diverse teaching environments. Especially in the context of the information age, the TPACK knowledge structure provides a theoretical framework for primary school Chinese language teachers to enhance teaching effectiveness by integrating teaching methods with modern educational technology. Moreover, the TPACK model considers individual differences among teachers in combining technology, content, and teaching knowledge to meet the diverse needs of learners. Therefore, the theoretical framework of the TPACK knowledge structure for preservice primary school Chinese language teachers is not merely a teaching theory but a cross-disciplinary integration model, offering guidance for professional development and theoretical support for cultivating primary school Chinese language teachers with modern educational concepts and teaching abilities.

2.2 Analysis of the TPACK Knowledge Structure Framework for Preservice Primary School Chinese Language Teachers

The analysis of the TPACK knowledge structure framework for preservice primary school Chinese language teachers involves an in-depth exploration of three intertwined domains (technological knowledge, content knowledge, and pedagogical knowledge) and further identifies their complex interactions within. Teachers must not only be familiar with the core concepts and teaching methods of the Chinese subject but also understand and master how to promote student learning through appropriate educational technology. By deeply analyzing the intersections of technological, content, and pedagogical knowledge, it can reveal how teachers combine these knowledges to adapt to different teaching situations [2]. For example, the intersection of technology and content knowledge may involve using specific instructional tools to explain complex concepts in Chinese language, while the intersection of content and pedagogical knowledge may emphasize designing effective teaching strategies to meet individual student differences. Furthermore, the complete intersection of technology, content, and pedagogical knowledge, the core of the TPACK framework, requires teachers to flexibly utilize all these elements to create an effective learning environment. The analysis of the TPACK knowledge structure framework for preservice primary school Chinese language teachers can also reveal how teachers balance these complex factors in actual teaching [3]. This involves a thorough analysis of how teachers adjust their technology, content, and pedagogical knowledge according to specific teaching goals and student needs, and how they continuously improve teaching practice through reflection and adjustment. In addition, this analysis can help identify potential barriers and facilitating factors affecting the development of TPACK in preservice primary school Chinese language teachers, such as the educational system, resource constraints, and personal beliefs. Overall, through a comprehensive analysis of the TPACK knowledge structure framework for preservice primary school Chinese language teachers, it deepens the understanding of the integrated use of modern educational technology and teaching methods in primary school Chinese language education, offering more precise and targeted guidance for training and supporting preservice primary school Chinese language teachers.

2.3 Characteristics of the TPACK Knowledge Structure Framework for Preservice Primary School Chinese Language Teachers

The characteristics of the TPACK knowledge structure framework for preservice primary school Chinese language teachers manifest in its unique integrative, dynamic, and situational aspects. Integration is reflected in the need for teachers to meld technological, content, and pedagogical knowledge to facilitate students' Chinese language learning [4]. This requires not only mastery of knowledge in a single domain but an understanding of the intersections and interactions among these domains. For example, teachers must have the ability to use technological tools to present Chinese content while understanding how to adjust teaching strategies to accommodate different learners. Dynamism is reflected in the fact that the TPACK knowledge structure is not static but evolves with the accumulation of teachers' experience and skill development.

Teachers must constantly reflect and adjust their teaching practices to better adapt to the changing educational environment and student needs. This may involve reassessing the technological tools used or reconsidering how specific teaching strategies are combined with Chinese content. Situationality emphasizes that the TPACK knowledge structure is determined by specific teaching situations, and teachers must flexibly apply and adjust their TPACK knowledge to meet the needs of particular subjects, grades, and learners. For example, teachers may need to select different teaching methods and technological tools for different Chinese themes to more effectively communicate with students and facilitate their understanding. Overall, these characteristics of the TPACK knowledge structure framework for preservice primary school Chinese language teachers reflect the complexity and diversity of modern education. They require teachers not only to have extensive professional knowledge and skills but also the ability to integrate across disciplines, engage in continuous learning, and adapt flexibly. This provides new perspectives and challenges for teachers' professional development and educational reform, offering profound insights for educators, researchers, and policymakers on how to support and train preservice primary school Chinese language teachers to adapt to the ever-changing educational environment.

3. Construction of the TPACK Knowledge Structure Model for Preservice Primary School Chinese Language Teachers

3.1 Measurement of the Levels of Constituent Elements of TPACK Knowledge Structure for Preservice Primary School Chinese Language Teachers

Measuring the levels of constituent elements of the TPACK knowledge structure for preservice primary school Chinese language teachers is a complex process that precisely assesses teachers' knowledge and skills in technology, content, and pedagogy [5]. This process involves a series of quantitative and qualitative methods to capture teachers' levels and abilities in various components of TPACK. The measurement may include self-report questionnaires, observations, interviews, and simulated teaching, enabling a comprehensive understanding of teachers' TPACK knowledge structure. Self-report questionnaires can provide teachers' subjective assessments of their technological, content, and pedagogical knowledge, while observations and interviews offer third-party insights into how teachers integrate these domains in actual teaching. Additionally, simulated teaching can emulate real teaching situations in controlled environments, allowing researchers to observe and evaluate teachers' reactions and strategies to different teaching challenges. Due to the complexity and diversity of language education, these methods must be flexibly applied and may require customization based on specific subjects, grades, and cultural backgrounds. For example, assessing content knowledge in primary school Chinese language teachers may involve an in-depth evaluation of their understanding in linguistics, literary comprehension, and teaching strategies. Furthermore, the assessment of technological knowledge might include measuring teachers' abilities in using specific educational technology tools such as smart teaching platforms or multimedia resources. Overall, measuring the levels of constituent elements of the TPACK knowledge structure for preservice primary school Chinese language teachers is a multi-dimensional, multi-method process aimed at capturing and understanding the complex knowledge and skills required in a modern educational environment, providing a strong foundation and direction for teacher training and educational reform.

3.2 TPACK Knowledge Structure Model for Preservice Primary School Chinese Language Teachers

The study of the TPACK knowledge structure model for preservice primary school Chinese language teachers focuses on constructing and validating a theoretical model that reflects the integration of technological, content, and pedagogical knowledge [6]. The core purpose is to ensure that teachers can effectively integrate and apply these domains in a modern educational environment, thereby optimizing students' learning experiences. Building this model emphasizes identifying and describing the relationships and interactions between the three main components of TPACK. This involves an in-depth exploration of how technology supports the delivery of Chinese

education content, fosters innovation in teaching strategies, and how these three elements collectively influence student learning outcomes. Additionally, the model considers external factors such as cultural background, school environment, and socio-economic conditions, which may indirectly affect teachers' TPACK knowledge structure and application. In verifying the accuracy and applicability of the model, research methods typically include in-depth case studies, long-term longitudinal studies, and large-scale cross-sectional surveys. For instance, detailed classroom observations can reveal how teachers integrate technology, content, and pedagogy in real teaching scenarios, while questionnaires can collect extensive data for statistical analysis to validate the model's assumptions and constructs. The ultimate goal of this model is to provide teachers with a practical framework to identify their strengths and weaknesses in various TPACK areas and offer insights to educators and policymakers on how to better support and train preservice primary school Chinese language teachers. Through ongoing research and reflection, the TPACK knowledge structure model provides theoretical support and practical guidance for the future development of Chinese language education, promoting an organic integration of educational technology, teaching methods, and subject content.

3.3 Connotation and Inter-Element Relationships of the TPACK Knowledge Structure for Preservice Primary School Chinese Language Teachers

The exploration of the connotation and inter-element relationships of the TPACK knowledge structure for preservice primary school Chinese language teachers involves an in-depth analysis of the essence of the structure and the complex interactions among its different constituent parts[7]. The connotation of the TPACK knowledge structure is not merely a knowledge system but a philosophy of teaching practice emphasizing seamless integration among technology, content, and pedagogy. In this structure, Content Knowledge (CK) concerns teachers' understanding of the Chinese language subject; Pedagogical Knowledge (PK) involves teaching methods and strategies; Technological Knowledge (TK) relates to the use of educational technology tools. The inter-element relationships form a dynamic, interdependent system where, for example, the interaction between technology and content explains how technology supports the delivery of specific Chinese content, the interaction between content and pedagogy emphasizes how effective teaching methods facilitate students' understanding of Chinese knowledge, and the interaction between technology and pedagogy explores how to use technological tools to enhance teaching effectiveness. At the core of TPACK is the complete integration of these three elements, where teachers must flexibly apply technology, content, and pedagogical knowledge to adapt to various teaching scenarios and student needs. It is noteworthy that this integration is not linear but a complex adaptive process requiring teachers to continually reflect and adjust in practice. Additionally, this knowledge structure is influenced by various external factors such as school policies, resource availability, and socio-cultural background, which may indirectly shape the formation and application of teachers' TPACK knowledge structure. Overall, the analysis of the connotation and inter-element relationships of the TPACK knowledge structure for preservice primary school Chinese language teachers reveals a multi-level, multi-dimensional system. Within this system, individual elements are both independent and interdependent, constituting a teaching practice paradigm that emphasizes holism, dynamism, and contextuality. These characteristics reflect the complexity and diversity of modern education, requiring teachers not only to possess a wide range of professional knowledge and skills but also the ability to integrate across disciplines, engage in continuous learning, and adapt flexibly. This offers new perspectives and challenges for teachers' professional development and educational reform and provides in-depth insights for educational researchers and policymakers on how to support and train preservice primary school Chinese language teachers to adapt to a constantly changing educational environment.

4. Realistic Teaching Patterns of Preservice Primary School Chinese Language

Teachers Based on the TPACK Structure Model

4.1 Analysis of Classroom Behavior Dimensions for Preservice Primary School Chinese Language Teachers

The analysis of classroom behavior dimensions for preservice primary school Chinese language teachers involves an in-depth exploration of teachers' behavior patterns and strategies in teaching practice [8]. This analysis focuses on how teachers implement the integration of the TPACK knowledge structure through specific behaviors to promote students' learning of the Chinese language. Classroom behavior dimensions include the teacher's teaching style, interaction patterns, assessment strategies, and technology usage, collectively reflecting how theoretical knowledge is translated into actual teaching practice. For instance, a teacher's style may manifest in balancing guidance and exploration to encourage student participation; interaction patterns involve how teachers communicate and collaborate with students to foster deep understanding and reflection; assessment strategies pertain to how teachers evaluate and provide feedback on students' progress through formal and informal means; technology usage involves how modern educational technology is integrated to enhance teaching effectiveness and student engagement. These dimensions are interconnected and form a complex system of teaching practice. Influences from external factors like school culture, curriculum standards, and student needs can shape or limit classroom behavior. By analyzing these dimensions, insights into how teachers translate TPACK into specific teaching practices can be gleaned, offering targeted insights for teacher training and educational reform. This analysis emphasizes teachers' subjective judgment and adaptability, as well as how they flexibly employ various teaching strategies and tools to meet diverse learning needs in complex and changing educational environments.

4.2 Analysis of Classroom Teaching Media Dimensions for Preservice Primary School Chinese Language Teachers

The analysis of classroom teaching media dimensions focuses on how teachers use diverse teaching media to support and enhance Chinese language teaching practices [9]. In the modern educational environment, the selection and utilization of teaching media have become key elements in instructional design, ranging from traditional paper materials to advanced digital technologies and multimedia resources. This dimension explores how teachers select and integrate different media according to subject content, student needs, and teaching goals. The choice is not arbitrary but based on teachers' deep understanding of subject content, student characteristics, and teaching methods. Challenges and potential barriers like technological constraints, professional development needs, or school policies may also be identified. Overall, this analysis provides a focused perspective on how teachers integrate and use technology, content, and pedagogical knowledge in the modern educational environment, revealing the specific roles and impacts of that dimension in promoting educational quality and innovation, as well as potential future developments. It offers concrete, targeted insights for educational research and policy-making, helping to support and train preservice primary school Chinese language teachers more precisely to meet the ever-changing educational demands and challenges.

4.3 Analysis of TPACK Dimensions for Preservice Primary School Chinese Language Teachers

The TPACK dimensions analysis for preservice primary school Chinese language teachers concentrates on how teachers integrate technology, content, and pedagogical knowledge in teaching practice to achieve educational objectives and meet student needs. This analysis underscores TPACK not only as a knowledge framework but also as a practice paradigm, requiring teachers to flexibly apply and balance these three domains [10]. In the technological dimension, teachers must master how to use modern educational technology to support and enhance Chinese language education. In content, teachers must deeply understand core concepts and themes of the subject to select proper teaching methods and technological tools. In pedagogy, teachers must know how to design and implement effective strategies to foster student participation, understanding, and reflection.

The integration of these dimensions is dynamic and complex, involving constant adjustments to create an effective learning environment. External factors like school culture, technological support, and socio-economic backgrounds may indirectly shape the formation and application of TPACK. Overall, this analysis offers profound insights into how teachers integrate technology, content, and pedagogy in complex and varying teaching environments, highlighting the complexity, dynamism, and contextuality of this integration, and its key role in advancing quality and innovation in Chinese language education. It also emphasizes teachers' subjective judgment and adaptability, and how they continuously develop and refine their TPACK practice through reflection and learning, providing valuable insights and directions for educational research and reform.

4.4 Analysis of Classroom TPACK Trends Focusing on a Specific Dimension

The analysis of classroom TPACK trends focusing on a specific dimension allows researchers to deeply understand how teachers emphasize a particular aspect of TPACK in a specific teaching environment. For example, if the focus of the analysis is on the technology dimension, the research will concentrate on how teachers use modern educational technology to support and enhance Chinese language teaching practices, and how such emphasis affects teaching effectiveness and student learning. This might involve detailed analysis of strategies and skills in selecting and using digital resources, online platforms, and multimedia tools. Similarly, specific analysis of the content or pedagogical dimension will focus on teachers' expertise and practice in these areas, and how this knowledge and practice integrate with technology to support students' learning of the Chinese language. Analyzing trends in a specific dimension can reveal changes and developments in different teaching situations and cultural contexts, as well as possible future trends. Potential challenges and obstacles affecting the practice of a particular TPACK dimension can also be identified. Overall, this trend analysis offers a more focused perspective on how teachers integrate and apply technology, content, and pedagogy in the modern educational environment, revealing the specific role and impact of that dimension in driving educational quality and innovation, as well as potential future directions. It provides specific, targeted insights for educational research and policy-making, aiding in more precisely supporting and training preservice primary school Chinese language teachers to meet the ever-changing educational needs and challenges.

5. Factors Affecting the Differences in TPACK Knowledge Structure of Preservice Primary School Chinese Language Teachers and Configuration Strategies

5.1 Differences in Individual, Organizational, Subject, Environmental, and Technological Factors

The realization and application of the TPACK knowledge structure in preservice primary school Chinese language teachers are influenced not only by the teachers themselves but also by the combined effect of individual, organizational, subject, environmental, and technological factors. At the individual level, teachers' beliefs, attitudes, and professional abilities may affect how they view and use TPACK, such as an open attitude towards technology promoting its use in teaching. Organizationally, the structure, culture, and policies of schools and education systems may either foster or limit TPACK's implementation. For example, a school culture that emphasizes innovation and collaboration might support teachers' TPACK practices. Subject-wise, the characteristics and needs of a subject, like the emphasis on literary understanding and critical thinking in Chinese language, can shape teachers' expertise in content and teaching. Environmentally, social, economic, and cultural backgrounds may affect TPACK, such as regional technological infrastructure and social values influencing the feasibility and acceptance of educational technology. Technologically, available tools and resources shape teachers' technological knowledge and practice, like advanced educational technology platforms fostering innovation in teaching and assessment. These factors interact and intertwine to form a complex system shaping the formation and application of teachers' TPACK knowledge structure. Understanding these differing factors' interplay is crucial for

designing effective teacher training, support, and assessment strategies, ensuring that teachers can flexibly and effectively implement TPACK in various teaching situations to meet students' learning needs and drive educational quality and innovation.

5.2 Configuration Strategies for Preservice Primary School Chinese Language Teachers' TPACK Knowledge Structure

Research into configuration strategies for preservice primary school Chinese language teachers' TPACK knowledge structure covers a range of strategies and methods to promote and optimize integration and practice in technology, content, and pedagogical knowledge. These strategies must consider the complexity and diversity at multiple levels, including teachers, schools, subjects, and social environments. In teacher training, configuration strategies might include personalized professional development paths to meet specific needs and interests in various TPACK domains, and encouraging teachers to develop their TPACK through collaborative learning and reflective practice. At the school organization level, strategies may involve creating a culture that supports innovation and collaboration, and providing essential resources and support like educational technology infrastructure and expert guidance. Subject-wise, strategies might focus on how to align TPACK with specific subjects' particular needs and goals, such as emphasizing literary criticism and multimedia writing to shape teachers' content and technological knowledge. Socially and environmentally, strategies may take into account regional and community-specific situations and values to ensure that TPACK's implementation aligns with local educational goals and societal expectations. Overall, the study of configuration strategies for preservice primary school Chinese language teachers' TPACK knowledge structure offers a comprehensive and flexible approach to understanding and supporting teachers' complex tasks in the modern educational environment, stressing that strategies must be tailored to the specific circumstances of teachers, schools, subjects, and social environments. This research not only aids in advancing educational quality and innovation but also provides profound insights and guidance for educational researchers, policymakers, and practitioners on how to better support and train preservice primary school Chinese language teachers.

6. Conclusion

Upon thorough investigation, this study distinctly reveals that, in the pedagogical knowledge structure of pre-service primary school language teachers from a technology-integrated perspective, technology not only underpins teaching methods and content but also, to a certain extent, propels its evolution and innovation. When compared to traditional teaching paradigms, this knowledge structure exhibits heightened dynamism, interactivity, and adaptability, facilitating deeper learning and reflection among students during actual teaching sessions. Most critically, teachers within this framework transition from mere dispensers of knowledge to collaborative architects of it, jointly exploring, communicating, and innovating with their students. This discovery underscores the pivotal role of technology integration in contemporary education. It not only offers fresh insights for the training of pre-service teachers but also delivers profound implications for educators and practitioners on how to better foster pedagogical innovation in an increasingly digitalized context.

Acknowledgement

This research was supported by the 2021 Research Fund of Shaanxi Xueqian Normal University for the project "A Study on the Teaching Knowledge Structure of Preservice Primary School Chinese Language Teachers from an Integrated Technology Perspective" (Project Number: 2021YBRS62).

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