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ENHANCING PRE-SERVICE PRIMARY FINE ARTS
TEACHERS' TECHNOLOGICAL PEDAGOGICAL
CONTENT KNOWLEDGE IN
SHANXI CHINA



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YANG JING

UNIVERSITI PENDIDIKAN SULTAN IDRIS

2025



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ENHANCING PRE-SERVICE PRIMARY FINE ARTS TEACHERS'
TECHNOLOGICAL PEDAGOGICAL CONTENT
KNOWLEDGE IN SHANXI CHINA

YANG JING

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(RESEARCH MODE)

FACULTY OF ART, SUSTAINABILITY AND CREATIVE INDUSTRY
SULTAN IDRIS EDUCATION UNIVERSITY

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ABSTRACT

This study investigates how to enhance the Technological Pedagogical Content Knowledge (TPACK) of pre-service primary school art teachers in China to support effective art education in the digital age. The research addresses the growing need for integrating technology in the art classrooms, where teachers must combine technological skills with pedagogical strategies and content knowledge to foster creativity and student engagement. The objectives of the study are twofold: to assess the current level and interrelationship of seven TPACK components—Technological Knowledge (TK), Content Knowledge (CK), Pedagogical Knowledge (PK), Pedagogical Content Knowledge (PCK), Technological Pedagogical Knowledge (TPK), Technological Content Knowledge (TCK), and the overall TPACK—and to determine how these dimensions influence teachers' readiness for effective art instruction. A quantitative research design was employed, involving a sample of 384 pre-service art teachers from teacher education institutions across China. Data were collected through a structured questionnaire adapted from validated TPACK scales and analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM) via SmartPLS 3.0. Results reveal that participants show high proficiency in TCK and TPK, moderate levels in TK and CK, and that TK and TPK significantly influence overall TPACK. In contrast, CK, PK, PCK, and TCK demonstrated limited impact. These findings underscore the need for teacher education programs to focus more on technology integration training tailored for arts education. This research contributes to the development of targeted strategies for enhancing TPACK among future art educators and offers policy-level recommendations for integrating digital tools and pedagogy in teacher preparation programs. It also addresses a research gap in the application of TPACK within the context of visual arts education in China.





PENINGKATAN PENGETAHUAN PEDAGOGI TEKNOLOGI DALAM KALANGAN GURU SENI HALUS PRAPERKHIDMATAN SEKOLAH RENDAH SHANXI CHINA

ABSTRAK

Kajian ini menyelidik cara untuk meningkatkan Pengetahuan Kandungan Pedagogi Teknologi (TPACK) dalam kalangan guru seni halus pra-perkhidmatan sekolah rendah di China bagi menyokong pendidikan seni yang berkesan dalam era digital. Penyelidikan ini menangani keperluan yang semakin meningkat untuk mengintegrasikan teknologi dalam bilik darjah seni, di mana guru perlu menggabungkan kemahiran teknologi dengan strategi pedagogi dan pengetahuan kandungan bagi memupuk kreativiti serta penglibatan pelajar. Objektif kajian ini adalah dua: menilai tahap semasa dan hubungan antara tujuh komponen TPACK, Pengetahuan Teknologi (TK), Pengetahuan Kandungan (CK), Pengetahuan Pedagogi (PK), Pengetahuan Kandungan Pedagogi (PCK), Pengetahuan Pedagogi Teknologi (TPK), Pengetahuan Kandungan Teknologi (TCK), dan keseluruhan TPACK, serta menentukan bagaimana dimensi ini mempengaruhi kesediaan guru untuk melaksanakan pengajaran seni yang berkesan. Reka bentuk kajian kuantitatif telah digunakan, melibatkan sampel seramai 384 orang guru seni pra-perkhidmatan dari institusi pendidikan guru di seluruh China. Data dikumpul melalui soal selidik berstruktur yang diadaptasi daripada skala TPACK yang telah disahkan, dan dianalisis menggunakan Pemodelan Persamaan Struktur Kaedah Kuasa Dua Terkecil Separa (PLS-SEM) melalui perisian SmartPLS 3.0. Keputusan menunjukkan bahawa peserta mempunyai tahap kecekapan yang tinggi dalam TCK dan TPK, serta tahap sederhana dalam TK dan CK, dan bahawa TK dan TPK memberi pengaruh yang signifikan terhadap keseluruhan TPACK. Sebaliknya, CK, PK, PCK, dan TCK menunjukkan impak yang terhad. Penemuan ini menekankan keperluan untuk program pendidikan guru memberi tumpuan lebih kepada latihan integrasi teknologi yang disesuaikan untuk pendidikan seni. Kajian ini menyumbang kepada pembangunan strategi khusus bagi meningkatkan TPACK dalam kalangan bakal pendidik seni dan menawarkan cadangan dasar bagi mengintegrasikan alat digital serta pedagogi dalam program persediaan guru. Ia juga menangani jurang penyelidikan dalam aplikasi TPACK dalam konteks pendidikan seni visual di China.



CONTENTS

	Page
DECLARATION OF ORIGINALWORK	ii
DECLARATION OF THESIS	iii
ACKNOWLEDGEMENT	iv
ABSTRACT	v
ABSTRAK	vi
CONTENTS	vi
LIST OF TABLES	xiii
LIST OF FIGURES	xv
LIST OF ABBREVIATIONS	xvi
LIST OF APPENDICES	xviii
CHAPTER 1 INTRODUCTION	
1.1 Introduction	1
1.2 Background of study	2
1.2.1 Overview	2
1.2.1.1 The Context of Art Education in China and the Challenges 2 Faced by Pre-Service Fine Arts Teachers	

1.2.1.2	The Role of Technology in Visual Arts Education and Its Necessity for More Effective Teaching	3
1.2.2	Future Trends in the Development of Art Education	5
1.2.3	New Requirements for Primary School Art Teachers' Literacy	9
1.2.4	The importance of Internet Technology and knowledge integration for pre-service art teachers	12
1.2.5	China's policies on Internet Technology and subject integration	16
1.3	Problem statement	20
1.4	Research Objectives	23
1.5	Research Questions	24
1.6	Research Hypothesis	25
1.7	Conceptual And Theoretical Framework	26
1.8	Operational Definition	32
1.9	Contribution Of The Study	40
1.10	Limitation Of The Study	44
1.11	Research Structure	48
1.12	Summary	49

CHAPTER 2 LITERATURE REVIEW

2.1	Introduction	50
2.2	TPACK Theory	51
2.2.1	Development and evolution of TPACK framework	54
2.2.2	TPACK and its application in education	59
2.3	Embodied Cognition Theory	65
2.3.1	Development and evolution of Embodied Cognition Theory	71

2.3.2	Embodied Cognition Theory and its application in education	74
2.4	Challenges in Developing TPACK for Pre-Service Teachers	80
2.4.1	The Current State of TPACK Development Among Pre-Service Primary Art Teachers	80
2.4.2	Key Issues in the Process of Developing TPACK for Pre-Service Teachers	84
2.5	Policies and Curriculum Standards for Primary Art Education in China	88
2.5.1	The Background of Curriculum Reform in Primary Art Education in China	88
2.5.2	Current Policy Support for Integrating Technology and Art	91
2.5.3	Challenges and Improvement Directions in Policies and Practice	94
2.5.4	China's Policy on Technology Integration and Subject Integration	97
2.6	Research on the teaching knowledge of primary school art teachers in China	99
2.7	Future Trends in Art Education	102
2.8	Summary	104

CHAPTER 3 METHODOLOGY

3.1	Introduction	107
3.2	Research Design	108
3.3	Population and Sample	114
3.4	Instrument	120
3.4.1	Technological Pedagogical Content Knowledge (TPACK) Scale	120
3.4.2	Demographic Information	123
3.5	Pilot Study	124
3.5.1	Validity	128
3.5.2	Reliability	131

3.6	Research Procedures	132
3.6.1	Data Collecting Procedures	132
3.6.2	Input Data	133
3.7	Data Analysis Procedures	134
3.7.1	Descriptive Data	135
3.7.2	Hypothesis Testing	136
3.8	Summary	138

CHAPTER 4 FINDING DATA

4.1	Introduction	139
4.2	Respondents' profile	140
4.3	Preliminary Analysis	142
4.3.1	Data Coding and Editing	144
4.3.2	Missing data	146
4.4	Assumptions Test	148
4.4.1	Assessment of Outliers	149
4.4.2	Assessment of Normality	151
4.4.3	Assessment of Multicollinearity	153
4.4.4	Assessment of Linearity and Homoscedasticity	154
4.4.5	Common Method Variance	156
4.5	Data Analysis	157
4.5.1	Descriptive Analysis of Data	157
4.5.2	Reliability Analysis	159

4.5.3	Validation of the Measurement Model	160
4.5.4	Validation of Structural Model	164
4.5.5	Hypothesis Testing	167
4.5.5.1	The Results of Research Objective 1	167
4.5.5.2	The Results of Research Objective 2	169
4.5.5.3	The Results of Research Objective 3	170
4.6	Interpretation of The Model	172
4.7	Summary of the Chapter	173
CHAPTER 5 DISSCUSSION & CONCLUSION		
5.1	Introduction	175
5.2	Discussion of Results	176
5.2.1	Discussion of Research Objective 1	177
5.2.1.1	Detailed Analysis of Empirical Findings	178
5.2.1.2	Comparative Literature Review	182
5.2.1.3	Unique Insights and Underlying Reasons	183
5.2.2	Discussion of Research Objective 2	184
5.2.2.1	Detailed Analysis of Correlation Findings	185
5.2.2.2	Comparative Literature Review	188
5.2.2.3	Unique Insights and Underlying Reasons	190
5.2.3	Discussion of Research Objective 3	193
5.2.3.1	Detailed Analysis of Empirical Findings	194
5.2.3.2	Comparative Literature Review	195

5.2.3.3	Unique Insights and Underlying Reasons	197
5.3	Implications	199
5.3.1	Theoretical Implications	199
5.3.1.1	Enhancement of TPACK Framework Understanding	200
5.3.1.2	Integration of Cultural and Regional Factors	205
5.3.1.3	Revisiting Teacher Education Curricula	211
5.3.1.4	Broadening the Scope of TPACK Research	216
5.3.2	Managerial Implications	222
5.3.2.1	Curriculum Development in Teacher Education	223
5.3.2.2	Professional Development for Educators	227
5.3.2.3	Resource Allocation and Training	230
5.3.2.4	Adaptation to Regional Educational Needs	234
5.3.2.5	Encouraging Collaborative Research and Practice	237
5.4	Suggestions	240
5.4.1	Enhancing Technological Integration Abilities	241
5.4.2	Using Integrated Technology, Teaching Methods, and Subjects as Catalysts for the Professional Growth of Pre-Service Primary Art Teachers	249
5.4.3	Fostering Reform and Student Development through Innovation and Practice in Art Education	257
5.5	Conclusion	263
	REFERENCES	268
	APPENDIX	283

**LIST OF TABLES**

Table No.		Pages
1. 1	Primary school subjects and weekly class hours by grade level	40
3. 1	Sampling distribution	118
3. 2	Adapted scale (Wang,2020)	122
3. 3	Frequency table	126
3. 4	Amendments of TPACK scale	128
3. 5	Factor analysis for the scale of pilot test	130
3. 6	Construct Reliability	132
3. 7	Procedure for administering the questionnaire	133
3. 8	Research Questions and Statistical Analysis Used	136
3. 9	Research Questions,hypothesis and Statistical Analysis Used	137
4. 1	Demographic Information	141
4. 2	Missing Data	147
4. 3	Descriptive Statistics for Descriptive Statistics	150
4. 4	Assessment of Normality	152
4. 5	Coefficientsa	154
4. 6	EFA Result for Harman's Single-factor Test	157
4. 7	Descriptive Statistics (n =305)	158
4. 8	Reliability Statistics	160



4. 9	Data Reliability and Validity Results	161
4. 10	Results of Discriminant Validity	164
4. 11	R ² and Q ² of Endogenous Latent Variables	165
4. 12	The f square Effect Size	166
4. 13	Correlation	169
4. 14	Results of Research Objective 3	171



LIST OF FIGURES

Figures No.		Pages
1. 1	TPACK framework (Koehler & Mishra,2006)	27
1. 2	Conceptual and theoretical framework	31
3. 1	Onion model for research design(Saunders, Lewis, and Thornhill ,2000)	108
3. 2	Sampling framework	116
4. 1	Scatterplot for Examining Linearity of Residuals and Homoscedasticity	155
4. 2	Structural Model of TPACK Components	167





LIST OF ABBREVIATIONS

AVE	Average Variance Extracted
CK	Content Knowledge
CR	Composite Reliability
CI	Confidence Interval
CI	Confidence Interval
df	Degrees of Freedom
ICT	Information and Communication Technology
M	Mean
PCK	Pedagogical Content Knowledge
PK	Pedagogical Knowledge
PLS-SEM	Partial Least Squares Structural Equation Modeling
R ²	Coefficient of Determination
SD	Standard Deviation
SE	Standard Error
SEM	Structural Equation Modeling
SmartPLS	Software for Partial Least Squares Structural Equation Modeling
SPSS	Statistical Package for the Social Sciences
TK	Technological Knowledge
TPACK	Technological Pedagogical Content Knowledge





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VIF

: Variance Inflation Factor



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LIST OF APPENDICES

- A TPACK SCALE
- B Adapted scale
- C Consent to take part in research
- D Questionnaire
- E Ethical Approval Letter





CHAPTER 1

INTRODUCTION



1.1 Introduction

This chapter deals with the background of the study, statement of problems, research objectives, research questions, significance of the study, limitations of the study, terms of definition, conceptual framework, and hypotheses. The summary of this chapter is presented at the end of each chapter.





1.2 Background of study

1.2.1 Overview

Art education has long been recognized as an important aspect of a well-rounded education that contributes to the development of students' creativity, critical thinking, and cultural literacy (Winner, Hetland, Veenema, & Sheridan, 2013).

1.2.1.1 The Context of Art Education in China and the Challenges Faced by Pre-Service Fine Arts Teachers



While previous research has explored TPACK for in-service teachers, relatively little attention has been paid to pre-service teachers in arts education settings. In-service teachers are at a critical time in their training as they develop their knowledge and skills to become effective teachers. Understanding pre-service teachers' TPACK is important to inform teacher education programs and provide guidance on the challenges and opportunities for teachers to integrate technology in the arts classroom.

In this study, the researcher's journey through the intricate realm of art education commenced with a solid academic foundation, culminating in the attainment of a Bachelor's degree in Fine Arts. This educational odyssey has uniquely equipped the researcher with a nuanced understanding of the multifaceted nuances inherent in the discipline. The





subsequent immersion in actual primary school classrooms, both as a student and an educator, has lent an insightful dimension to the researcher's grasp of the practical challenges and opportunities encountered by pre-service primary fine arts teachers.

The inception of this research question has been driven by a confluence of scholarly intrigue and pedagogical exigency. The contemporary educational landscape, punctuated by the swift integration of technology, demands an incisive exploration of its implications within the realm of art education. The researcher's engagement in the capacity of an art educator further underscores the resonance of this issue, having witnessed firsthand the evolving challenges encountered by pre-service teachers in navigating the convergence of artistic expression and digital innovation.



1.2.1.2 The Role of Technology in Visual Arts Education and Its Necessity for More Effective Teaching

In recent years, advances in technology and the increasing emphasis on 21st-century skills have made it necessary for art teachers to integrate technology into their teaching practices. To effectively integrate technology, art teachers need adequate pedagogical and content knowledge of technology (TPACK) (Mishra & Koehler, 2006). The TPACK framework emphasizes the importance of integrating technology, pedagogy, and content knowledge for effective teaching and learning (Koehler & Mishra, 2009).





TPACK for primary art teachers is critical in preparing them to meet the challenges of teaching in the digital age. However, the integration of technology and art education presents new challenges and opportunities for teachers. Technological Pedagogical Content Knowledge (TPACK) has emerged as a framework for understanding the complex knowledge required for teachers to effectively integrate technology in their teaching practices (Mishra & Koehler, 2006).

With this in mind, the purpose of this study was to investigate the TPACK of pre-service primary art teachers in an art education context. By exploring the relationship between technology, instruction, and content knowledge, this study sought to gain a comprehensive understanding of the TPACK of pre-service teachers needed to effectively integrate technology in art education. Through this study, we hope to provide pre-service primary art teachers with a better understanding of the technology needed to effectively integrate technology in their teaching practices through knowledge and skills to contribute to the field of art education. This understanding can inform teacher education programs, support teachers' professional development, and ultimately improve the quality of art education in schools.





1.2.2 Future Trends in the Development of Art Education

Since the 21st century, with the trend of economic globalization, the integration of culture and technology among countries has become increasingly close, leading to a trend of diversification and integration in art education. Diversification refers to the various art education trends with different value orientations in different countries, such as discipline-based art education (DBAE), life-oriented art education, and innovation-oriented art education. Integration refers to the integration of art and technology, which has become a new trend, resulting in the emergence of comprehensive art education, such as STEAM education and maker education.



The development of new media materials and the emergence of diverse forms of expression have expanded the content of traditional "art" education, breaking the old standards and incorporating new knowledge systems into the educational field. In the 2011 edition of the "National Curriculum Standards for Primary School Art Education" (developed by the Ministry of Education of the People's Republic of China), the nature of the art curriculum was defined as "practical". Students use traditional or new media to create works of art, developing their imagination, practical skills, and creativity. Traditional art education focuses on the cultivation of painting techniques rather than artistic accomplishment and vision.





The younger generation has grown up in an era of visual culture, accompanied by the internet, social media, digital mobile videos, and blogs. In terms of content, reading materials have become more superficial, intuitive, easy to understand, and diversified. With the gradual penetration of new technologies in the field of education, new technologies such as APP software, the internet, VR, and XR can all become new carriers of basic art education. Digital museums, art websites, and digital art databases can all become new platforms for basic art education. Digital image practice, virtual art practice, and new media art practice can all become new content for basic art education.

Gamification has emerged as a transformative trend in art education, leveraging game mechanics to engage and motivate students. Platforms like Minecraft Education and ArtRage provide immersive environments where students can experiment with design and artistic concepts in a playful context. By introducing elements like challenges, leaderboards, and rewards, gamification not only fosters creativity but also enhances collaboration and critical thinking skills. This trend aligns with modern pedagogical approaches that prioritize student engagement and the cultivation of 21st-century skills in art education.

The advent of artificial intelligence (AI) is revolutionizing art education by providing new tools and opportunities for creativity and learning. AI-powered applications can assist students in generating unique art pieces, offering instant feedback on artistic techniques, and personalizing learning experiences to suit individual needs. Moreover, AI tools like DeepArt and Runway ML enable students to explore generative art, transforming how they





perceive and create artwork. For art educators, AI presents an opportunity to integrate advanced analytical tools for assessing student progress and tailoring instruction. The rise of AI in art education signifies a shift towards more interactive, data-driven, and adaptive learning environments.

With the development of the times, the connotation and nature of art education have undergone tremendous changes. Modern art education is a general education, and "sharing", "information", "dataization", and "popularization" are common characteristics of modern Chinese art education. Feldman (1980) suggested that "teachers and students should focus on learning art outside the classroom, and students should not only express themselves artistically but also learn the art of other cultures" (Feldman, 1980). Kylie Pepler (2013), an expert in education and art education at Indiana University in the United States, pointed out that in the digital age, people use social media to learn art, which can stimulate children's interest in learning art, because on social media in the digital age, people can also communicate about art creation while learning art. Many children consider digital technology a necessary tool for learning art (Pepler, 2013).

When discussing art education, Chinese painter Liu Dawei stated that "the realization of the Chinese dream requires high-quality talents who not only possess advanced thinking, exquisite skills, and good health, but also have sound character, noble sentiment, and good taste. As art education continues to evolve, cultural sensitivity becomes a vital component of the curriculum. Integrating global art traditions into the classroom can help students





appreciate diverse perspectives and foster cross-cultural understanding. For instance, students can learn about traditional Chinese ink painting alongside digital animation techniques, encouraging them to draw connections between historical and contemporary art forms. This approach not only enriches students' aesthetic appreciation but also prepares them to navigate a globalized world with cultural empathy and awareness (Zhao et al., 2021).

All of these are closely related to the art education of young people" (Liu, Zhang, & Gong, 2014). As the most critical link in art education, art teachers need a more modern and diverse knowledge structure. Art teachers must enable students to establish aesthetic and discernment awareness in art education, cultivate their basic visual literacy in the context of visual culture, and master the "visual literacy" of handling "graphics and images" (Xu, 2015). This will enable students to have judgmental abilities on the content and form of visual images and possess healthy aesthetic concepts. Students must develop their visual literacy.

The future of art education lies in embracing interdisciplinary approaches that bridge art with other fields such as science, engineering, and mathematics. STEAM education, which incorporates the arts into STEM disciplines, exemplifies this trend by fostering creativity alongside technical skills. Projects that combine artistic expression with coding, robotics, or environmental studies allow students to tackle complex, real-world problems through innovative thinking. This holistic approach not only broadens students'





understanding of art but also equips them with versatile skills applicable across various domains (Pepler et al., 2018).

In summary, under the impact of the digital era, the future development trend of art education will show a tendency towards diversity and integration, and artistic aesthetics will become more diverse. Sustainability is becoming a key focus in art education, encouraging students to explore the intersection of art and environmental stewardship. Eco-art projects that use recycled materials, biodegradable paints, or natural elements help raise awareness about environmental issues while fostering creativity. Teachers can integrate sustainability into the curriculum by collaborating with local communities on public art installations that promote ecological values. This approach not only inspires students to think critically about their environmental impact but also empowers them to become change-makers through artistic expression. Art and technology are gradually integrated, and new technologies will become a brand-new carrier for art education.

1.2.3 New Requirements for Primary School Art Teachers' Literacy

In the age of artificial intelligence, human creativity is more important than in any other era. The basic education stage is an important stage for the cultivation of the whole person. The basic education stage should focus on the cultivation of the quality and creativity of all people. For the whole education business, primary education is the foundation of learning.





Based on the enlightenment and importance of primary art education, primary art teachers need to convey aesthetics in classroom practice, but also take up the mission of cultivating creativity in the next generation. Moreover, art education not only undertakes the function of art education, but also plays the role of shaping the beautiful hearts of children and youth.

Today, when the whole nation is calling for quality education, art education in primary school has received unprecedented attention. Today's art education is an education to cultivate a well-rounded person, and art teachers, as key players in art education, bear the heavy responsibility of cultivating students' visual ability. The teacher's knowledge affects the effectiveness of teaching, the quality of the teacher's ability affects the quality of education, and the teacher's attitude affects the physical and mental development of the educational target. The knowledge structure of art teachers is related to the effectiveness of art education. As professionals, primary school art teachers have their professional specialties. Primary school art teachers should have systematic professional knowledge and skills in art subjects and good professional ethics. Therefore, it is of contemporary significance to study the new knowledge structure of this special group and propose corresponding countermeasures in this study.

The document "Professional Standards for Primary School Teachers" was promulgated by the Ministry of Education in 2012, and upon its release, it sparked positive comments and widespread attention from society. The Standards set forth national standards for primary teacher education and primary teacher professional development in





China, reflecting an advanced educational philosophy and indicating directions for teacher professional development. The basic content of the Professional Standards for Primary School Teachers is divided into three dimensions: professional philosophy and teacher ethics, professional knowledge, and professional competence. The professional knowledge of teachers is explicitly included as one of the main contents of the professional standards (China Ministry of Education, 2012). China's Teacher Education Curriculum Standards explicitly state that in the process of teacher professionalization, improving professional standards should take teachers' professionalism as the main line, and the continuous enrichment of teachers' professional knowledge is the basis for professionalism improvement (Ministry of Education of China 2011). The information age has placed higher demands on primary school art teachers' literacy: teachers need not only to have professional knowledge and skills related to art subjects, but also need to adapt to the development of the times and take up the important task of developing students' digital visual skills, which means that teachers' professional development should be in line with the times and their teaching knowledge structure should be transformed by technological changes. Art teachers in the new era need to incorporate technological knowledge into their original pedagogical knowledge structure. Moreover, the rapid integration of digital and multimedia tools in education has redefined the role of art teachers. With tools such as augmented reality (AR) and virtual reality (VR), primary school art teachers now have the opportunity to create immersive learning experiences that can captivate students and enhance their understanding of artistic concepts. These technologies allow students to explore famous artworks virtually, manipulate 3D models, or even participate in



collaborative digital art projects. For art teachers, proficiency in these technologies not only enriches their teaching repertoire but also aligns with global trends in 21st-century education. Studies suggest that students exposed to technology-integrated art education demonstrate higher levels of engagement, creativity, and critical thinking (Chen et al., 2022).

1.2.4 The importance of Internet Technology and knowledge integration for pre-service art teachers

In June 2018, the Ministry of Education (MOE) promulgated the Guidelines for the Accreditation of Teacher Education Programs in General Higher Education Institutions (hereinafter referred to as the "Accreditation Guidelines") and launched the teacher education accreditation process. For the first time, the teacher education accreditation process is based on the principle of "output orientation" and the effectiveness of pre-service teacher development, and focuses more on what pre-service teachers have learned and what they can do. The quality of teacher training is evaluated in eight dimensions: training objectives, graduation requirements, curriculum and teaching, cooperation and practice, faculty, support conditions, quality assurance, and student development (Chinese Ministry of Education, 2017). The documents cited in the Accreditation Guide regarding pre-service teachers' knowledge and competencies are the Professional Standards for Primary School Teachers (for Trial Implementation) (Chinese Ministry of Education, 2012) and the Standards for Information Technology Application Competencies for Primary and



Secondary School Teachers (for Trial Implementation) (Chinese Ministry of Education, 2014). Among them, the Standard for IT Application Competence of Primary and Secondary School Teachers (Trial) examines the awareness and competence of primary and secondary school teachers in applying IT to optimize classroom teaching and applying IT to transform learning in two stages, in five dimensions: technology literacy, planning and preparation, organization and management, assessment and diagnosis, and learning and development (Chinese Ministry of Education, 2014).

The rise of Internet-based educational platforms has further emphasized the importance of knowledge integration for pre-service art teachers. Platforms like Google Classroom, Microsoft Teams, and other Learning Management Systems (LMS) provide pre-service teachers with tools to design, manage, and deliver engaging art lessons. These platforms support interactive features, such as polls, quizzes, and collaborative projects, which can be tailored to the unique needs of art education. By mastering these platforms, pre-service teachers can effectively engage digital-native students while streamlining administrative tasks. Additionally, online resources and communities of practice enable art teachers to exchange ideas, access professional development opportunities, and stay updated on emerging trends in art education (Zhao et al., 2021).





The goal of the new curriculum reform is that primary school teachers are required to be able to carry out teaching activities in a localized and creative manner. Among other things, to seek employment, former teachers must have a knowledge-based structure. However, the development of teachers' knowledge does not happen overnight; it is in line with their inherent cognitive understanding, behavioral tendencies, and value orientations. Therefore, the pre-service teacher learning phase before taking up employment is an important stage in developing the necessary literacy skills for teaching afterwards. However, pre-service teacher education is influenced by traditional test-based teaching, and there is often a gap between the existing learning content, learning methods, and learning abilities and the abilities required for the construction of teachers' knowledge structures.



For pre-service teachers of art at the pre-service stage, these gaps are reflected in the following aspects: 1. insufficient understanding of the theoretical background and practical requirements of the new curriculum reform; 2. insufficient depth of understanding of the nature of the knowledge structure and cultivation methods of technology integration in art subjects; 3. insufficient knowledge of the content of the knowledge of technology integration that should be developed at the pre-service stage.

Bridging these gaps requires targeted strategies during teacher training programs. Universities and training institutions must incorporate courses on digital literacy, multimedia art tools, and curriculum design into their programs. Workshops and hands-on training sessions focused on AR, VR, and other art-related technologies can prepare pre-





service teachers to leverage these tools effectively. Additionally, integrating fieldwork opportunities where pre-service teachers collaborate with in-service educators on technology-enhanced art lessons can bridge the theory-practice divide. These initiatives not only enhance their technological capabilities but also instill confidence in their ability to innovate in real classroom settings (Lin & Wu, 2020).

In this study, we conducted a study on the knowledge structure of technology integration from the perspective of pre-service teachers who will be engaged in art teaching in the future, so as to construct the content and development strategies of the knowledge structure of technology integration for pre-service art teachers. In order to better articulate the teaching practices necessary for entry into the profession, pre-service art teachers need to have a clear cognitive understanding of teaching philosophy, be able to act purposefully to improve their technology integration knowledge structure, and have a strong sense of belief and mission in the art teaching profession. These aspects of preparation are necessary to provide pre-service art teachers with a guideline and goal for improving their technically integrated knowledge structure during their school years.





1.2.5 China's policies on Internet Technology and subject integration

All aspects of education have been impacted by the development of information technology. Educational values, objectives, contents and teaching methods have all undergone dramatic changes. In order to adapt to this change, the state has guided the deep integration of IT and subjects at the policy level. In order to adapt to this change, the state has guided the deep integration of information technology and subjects from the policy level, which is not only the demand of subject development, but also the inevitable requirement for the continuous promotion of education informatization. This is not only the demand of subject development, but also the inevitable requirement for the continuous promotion of education informatization.



As the state attaches importance to education informatization, a series of important documents have been issued to put forward specific measures from teachers' perspective. In 2012, China's Ministry of Education issued the "Education Informatization". In 2012, the Chinese Ministry of Education released the Ten-Year Development Plan for Education Informatization (2011-2020), which once again emphasized the importance of education informatization, proposing the comprehensive and deep integration of modern information technology and education, leading the innovation of education concepts and education models with informatization, and giving full play to the supporting and leading role of education informatization in education reform and development (Chinese Ministry of Education, 2012). China's Ministry of Education, 2012). Article 36 of the basic content of





the 2012 Professional Standards for Primary School Teachers (for trial implementation) clearly states that primary school teachers should "have knowledge of information technology that is adapted to the modernization of educational content, teaching methods and approaches" (China's Ministry of Education, 2012). Subsequently, in October 2013, the Ministry of Education officially issued the document "Opinions on the Implementation of the National Primary and Secondary School Teachers' Information Technology Application Ability Enhancement Project", which clearly stated that the construction of teachers is the basic guarantee for the sustainable development of education informatization, and that information technology application ability is a requirement for teachers' necessary professional abilities in the informatization society, and began the strategic deployment of establishing a standard system for teachers' information technology application ability (Chinese Ministry of Education, 2013). The high level of integration between teachers' IT competency and subject teaching has become the focus of national policy attention.

However, how to integrate, how to establish a scientific evaluation system, and how to train teachers are the difficulties of national policy implementation. In April 2018, China's Ministry of Education issued the Action Plan for Education Informatization 2.0, which clearly states that the development of information technology, especially intelligent technology, should actively promote "Internet + education" and adhere to the core concept of deep integration of information technology and education teaching. It emphasizes the cultivation of information literacy of teachers and students, initiates the action of comprehensive improvement of information literacy, and vigorously improves teachers'





information literacy (China Ministry of Education, 2018).

Subsequently, in March 2019, China's Ministry of Education issued the Opinions of the Ministry of Education on Implementing the National Primary and Secondary School Teachers' Information Technology Application Ability Enhancement Project 2.0, further specifying that by 2022, a new mechanism for the development of teachers' information literacy that is school-based, classroom-based, application-driven, innovation-focused, and accurately assessed will be constructed, and teacher training in information technology application ability will be carried out around the country through demonstration projects to comprehensively promote the innovative development of integrating IT and education teaching (China Ministry of Education, 2019).



From a series of policy documents issued by the government, we can see that the state attaches great importance to the impact of information technology on education and vigorously requires primary and secondary school teachers to improve their information technology application skills, which reflects the state's imperative for information technology in education.

The deep integration of information technology and subjects and the two-way integration of technical knowledge and teaching knowledge are the inevitable development under the guidance of the national policy.





In summary, the imperative to dissect the Technological Pedagogical Content Knowledge (TPACK) paradigm within the context of pre-service primary fine arts teachers in China emanates from an amalgamation of educational exigencies. The digital epoch engenders a transformative shift, necessitating the cultivation of educators adept at synergizing traditional artistic domains with the realms of technology. This study assumes significance as it unravels the enigma of how pre-service teachers' proficiency in TPACK resonates with their aptitude to foster creative expression and aesthetic appreciation. By unraveling this intricate tapestry, this research augments the empirical bedrock essential for the refinement of pedagogical practices, ensuring the emergence of a cadre of art educators equipped to illuminate the interstice of artistic pedagogy and technological innovation.



Despite the growing recognition of the importance of Technological Pedagogical Content Knowledge (TPACK) in teacher education, there remains a notable gap in understanding how this framework specifically applies to the field of art education, particularly in the context of China. Existing literature predominantly focuses on TPACK in general education or in the context of STEM subjects, leaving a lacuna in comprehensively understanding how pre-service primary art teachers in China integrate technology with pedagogical and content knowledge. This gap is particularly significant given the unique challenges and opportunities presented by the integration of digital tools in art education. The need to explore this specific area is underscored by the rapid technological advancements and the evolving nature of art education, which demand a nuanced understanding of how future art educators are being prepared to meet these new





pedagogical challenges.

1.3 Problem statement

In the present digital era, the integration of knowledge from the realms of technology, educational pedagogy, and the arts has emerged as a significant developmental trend in contemporary art education (Anuar et al., 2019). However, uncertainties persist regarding whether aspiring primary school art teachers receive sufficient technological, educational, and artistic knowledge to effectively infuse technology into their teaching practices. This concern is particularly pronounced in the domain of art education, which involves creative and emotionally-driven learning. Successfully incorporating technology into art education poses a formidable challenge (Kara, 2021).

While there exists some research on the fusion of technology, pedagogy, and content knowledge (TPACK), the majority of studies have concentrated on STEM disciplines (Chai, 2019; Iswadi et al., 2020). There remains a relative scarcity of research in the field of visual arts education. Specifically, there is a dearth of empirical investigations into the development of TPACK among prospective primary school art teachers. This gap underscores the potential difficulties these future educators might encounter when attempting to integrate technology into their actual teaching routines. Insights from Tondeur et al. (2020) underscore the notion that aspiring teachers often lack the requisite





technological, pedagogical, and artistic knowledge needed for seamless integration of technology, which could subsequently impact their classroom performance.

Moreover, Ghavifekr's research (2016) points to numerous challenges faced by aspiring primary school teachers when implementing TPACK, including insufficient training and support, difficulties in accessing technology, and time constraints. These challenges have the potential to impede the effective integration of technology by aspiring primary school art teachers, thereby compromising the quality of education they provide. In the realm of art education, a teacher's professional competence is particularly pivotal. As revealed by Deng et al. (2017), art educators need to possess a comprehensive grasp of subject-specific knowledge and skills while also upholding strong ethical standards. However, the extent to which these aspects are emphasized during the training of prospective primary school art teachers warrants further investigation.

Against this backdrop, the current research aims to explore whether aspiring primary school art teachers possess adequate technological, educational, and artistic knowledge to seamlessly integrate technology and enhance the quality of education in the field of art. Simultaneously, the study delves into the challenges and opportunities faced by these aspiring educators in cultivating their TPACK competencies. Through surveys and data analysis, the research will ascertain their levels of expertise in technology, educational pedagogy, and the arts. Moreover, it will scrutinize their confidence levels and capabilities when it comes to integrating technology. A closer look will also be taken at potential





obstacles they encounter during their TPACK development, such as inadequate training and support, as well as time constraints. Drawing inspiration from the strategies proposed by Harris and Hofer (2020), the study will explore ways to enhance aspiring primary school art teachers' capacity to integrate technology effectively. This includes devising appropriate training programs, providing relevant support, and fostering collaborative opportunities to elevate their technology integration capabilities.

Thus, the central questions addressed by this research are: Do aspiring primary school art teachers possess sufficient technological, educational, and artistic knowledge to effectively integrate technology and enhance the quality of art education? Furthermore, the study aims to delve into the challenges and opportunities encountered by these educators in cultivating their TPACK competencies and explore how effective education and training can enhance their technology integration capabilities. By addressing these issues, the research strives to offer targeted recommendations and approaches for the professional development of aspiring primary school art teachers, thereby elevating the quality and efficacy of art education.

In conclusion, this study aims to provide substantive suggestions for the training and professional development of aspiring primary school art teachers. By gaining deeper insights into their needs and challenges, educational institutions can better design training programs and support measures to facilitate the effective integration of technology, fostering a more creative and vibrant environment for art education. Concurrently, the





research seeks to fill existing gaps in the field by offering novel theoretical and practical support for the development of TPACK in art education. In doing so, it strives to offer valuable insights for future educational reforms and teacher training initiatives.

1.4 Research Objectives

The purpose of this study is to analyze the Technological Pedagogical Content knowledge (TPACK) of pre-service primary art teachers in the context of art education and make recommendations for its development.



Specific objectives:

i. Examine and assess the proficiency of pre-service primary art teachers in the domains of technological knowledge (TK), content knowledge (CK), pedagogical knowledge (PK), pedagogical content knowledge (PCK), technological pedagogical knowledge (TPK), technological content knowledge (TCK), and technical pedagogical content knowledge (TPACK).

ii. Investigate the interconnections among the seven categories of knowledge within the TPACK framework for pre-service primary art teachers in China.





iii. Investigate the effects of pre-service primary art teachers' technical knowledge (TK), content knowledge (CK), pedagogical knowledge (PK), technical pedagogical knowledge (TPK), pedagogical content knowledge (PCK), and technical content knowledge (TCK) on technical pedagogical content knowledge (TPACK).

1.5 Research Questions

Based on the research objective of 1.4, the research question for this study was what is the level of Technological Pedagogical Content knowledge (TPACK) of pre-service primary art teachers in the context of art education?



The specific questions were:

i. What is the level of pre-service primary art teachers' technical knowledge (TK), content knowledge (CK), pedagogical knowledge (PK), pedagogical content knowledge (PCK), technical pedagogical knowledge (TPK), technical pedagogical content knowledge (TCK), and technical pedagogical content knowledge (TPACK)?





ii. Do there any significant relationship between the seven categories of knowledge in the TPACK structure of pre-service primary art teachers?

iii. What are the effects of pre-service primary art teachers' technical knowledge (TK), content knowledge (CK), pedagogical knowledge (PK), technical pedagogical knowledge (TPK), pedagogical content knowledge (PCK), and technical content knowledge (TCK) on technical pedagogical content knowledge (TPACK)?

1.6 Research Hypothesis

According to the research objectives and questions, the hypotheses for this study are:



H1: Pre-service primary art teachers in China have a high level of proficiency in technological knowledge (TK), content knowledge (CK), pedagogical knowledge (PK), pedagogical content knowledge (PCK), technological pedagogical knowledge (TPK), technological content knowledge (TCK), and technical pedagogical content knowledge (TPACK).

H2: There are significant relationships among the domains of pedagogical knowledge (PK), technological knowledge (TK), content knowledge (CK), pedagogical content knowledge (PCK), technological pedagogical knowledge (TPK), technological content knowledge (TCK), and technical pedagogical content knowledge (TPACK) for pre-service primary art





teachers in China.

H3: The technical knowledge (TK), content knowledge (CK), pedagogical knowledge (PK), technological pedagogical knowledge (TPK), pedagogical content knowledge (PCK), and technological content knowledge (TCK) of pre-service primary art teachers have a significant impact on their technical pedagogical content knowledge (TPACK).

1.7 Conceptual And Theoretical Framework

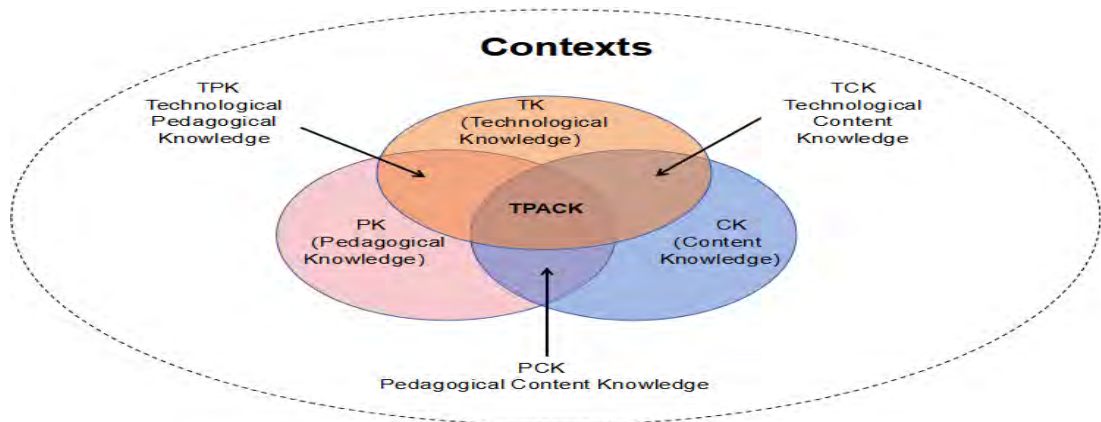
The theoretical framework of this study is based on the Technological Pedagogical Content Knowledge (TPACK) Theory proposed by Mishra and Koehler (2006) and Embodied Cognitive Theory (Shapiro, 2010). This framework provides a theoretical foundation for understanding how technology, pedagogy, and content knowledge intersect and influence each other in educational contexts.

The TPACK framework is composed of three knowledge domains: Content Knowledge (CK), Pedagogical Knowledge (PK), and Technology Knowledge (TK). These three domains intersect to form 4 sub-domains: Pedagogical Content Knowledge (PCK), Technological Content Knowledge (TCK), Technological Pedagogical Knowledge (TPK), and Technological Pedagogical Content Knowledge (TPACK). The TPACK framework is showed bellowed.



Figure 1.1

TPACK framework (Koehler & Mishra, 2006)



In this study, the focus is on examining the Technological Pedagogical Content Knowledge (TPACK) of pre-service primary fine arts teachers in arts education context. TPACK refers to the knowledge that teachers possess regarding how to teach a specific content area using technology. This includes an understanding of how technology can be used to support student learning, as well as how to effectively integrate technology into teaching practices.

Technology integration holds significant importance in modern education, but its successful implementation requires teachers to possess a wealth of educational practices, teaching skills, and background knowledge. Educational practices encompass a range of experiences and strategies employed by teachers in the classroom, while teaching skills encompass the ability to effectively impart knowledge. Additionally, teachers need to have a deep understanding of the background knowledge of their subject to seamlessly integrate technology into their teaching. To achieve effective technology integration, the interconnectedness between educational practices, teaching skills, and background



knowledge is crucial. Educational practices need to be adjusted based on subject matter and student needs, teaching skills aid in better knowledge transmission, and background knowledge provides the foundation for integrating technology in the teaching process. Therefore, the framework of this study focuses on how to comprehensively address these aspects in cultivating pre-service primary art teachers.

The TPACK framework has been widely used in research related to technology integration in education, and has been found to be a useful tool for analyzing teacher knowledge and practice (Al Lily et al., 2019; Archambault et al., 2010; Koh et al., 2013). By using this framework, this study aims to provide a comprehensive understanding of pre-service primary fine arts teachers' TPACK in arts education context and contribute to the field of teacher education and arts education.

Furthermore, the TPACK framework is consistent with other theoretical perspectives in education such as Embodied cognitive theory, which emphasize the importance of the interaction between the teacher, the student, and the learning environment (Mishra & Koehler, 2006). This framework also aligns with current trends in education, such as the integration of technology in teaching and learning, and the increasing importance of subject-specific pedagogy.

Specifically, the theory of embodied cognitive learning emphasizes that the environment in which the body is located has an important influence on human cognitive





processes, so the creation of an objective environment in the learner's learning process can be guided artificially and purposefully, and the transformation of the environment in the learner's learning environment, the creation of technological tools and other methods to change the stimulation of the learner's sensory experience can affect the acquisition of information in the learner's brain, stimulate or inhibit the learning process and learning outcomes(Shapiro,2019). Embodied cognitive theory provides a theoretical basis for the deep integration of information technology with subject curricula, and compared with traditional classrooms, technologies such as VR and AR can be used in the classroom. The inclusion of technologies such as VR and AR in the classroom can create the best sensory experience for learners, thus facilitating their access to information and enhancing learning outcomes. Embodied cognitive theory emphasizes the influence of the environment, so in the actual teaching of primary school art teachers, the teaching environment generated by technological factors constitutes an important part of teachers' teaching. In the actual teaching of primary school art teachers, the teaching environment generated by technological factors forms an important part of teachers' teaching.

Furthermore, the TPACK framework consists of seven dimensions: technological knowledge (TK), pedagogical knowledge (PK), content knowledge (CK), technological pedagogical knowledge (TPK), technological content knowledge (TCK), pedagogical content knowledge (PCK), and technological pedagogical content knowledge (TPACK). Among these dimensions, technological, pedagogical, and content knowledge are the three basic dimensions, while the other four dimensions result from the intersection of these three





basic dimensions.

In previous studies, scholars have explored the relationship and influence among the various dimensions of TPACK. Some studies have indicated that pedagogical knowledge and content knowledge are crucial for the development of TPACK (Mishra & Koehler, 2006). Meanwhile, other studies have found that the stronger the teacher's technological knowledge, the higher their ability to integrate TPACK (Niess, 2011). In addition, some research has suggested that the interaction between different dimensions has an important impact on the development of TPACK (Dalal et al., 2017).

In the context of art education, TPACK plays an important role for pre-service primary school art teachers. Art education is a highly interdisciplinary subject that requires teachers to integrate a variety of knowledge and skills in their teaching. The TPACK model provides a framework for integrating different knowledge and skills, which can help teachers better apply technology in art education and improve teaching effectiveness. Additionally, studying the relationship and influence among the various dimensions of TPACK for pre-service primary school art teachers can provide important guidance for teacher training and improve the quality and level of teaching.

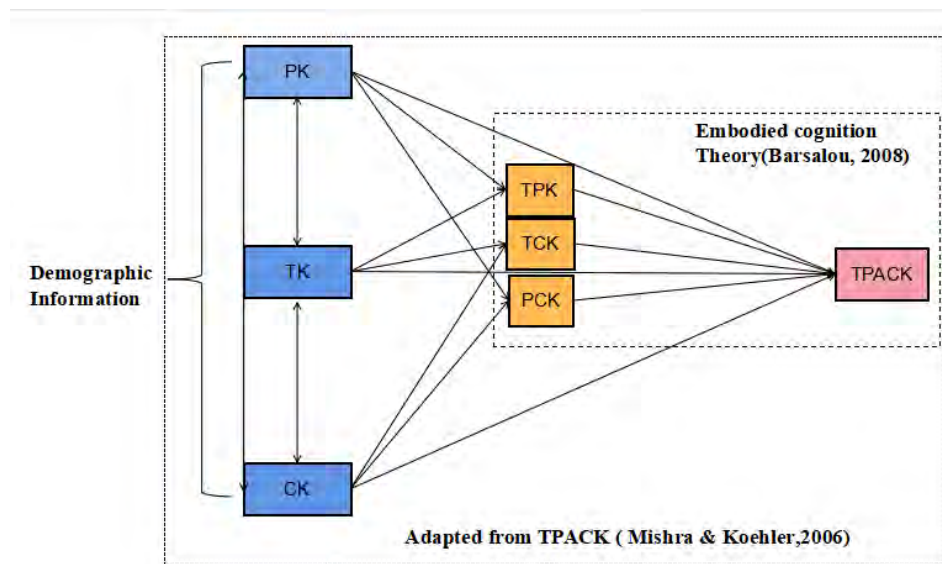
In conclusion, the TPACK theory and Embodied cognitive theory provides a robust and comprehensive theoretical foundation for understanding the intersection of technology, pedagogy, and content knowledge in education. By utilizing this framework, this study aims



to contribute to the understanding of pre-service primary fine arts teachers' TPACK in arts education context and inform teacher education and arts education practices. The conceptual and theoretical framework figure was followed:

Figure 1. 2

Conceptual and theoretical framework





1.8 Operational Definition

The following is a glossary of the terms used in this study.

i. Technological Pedagogical Content Knowledge(TPACK)

The junction of teachers understanding of curricular content, general pedagogies, and technologies is known as technological pedagogical content knowledge (Harris and Hofer, 2009). According to Schmidt et al. (2009), technological pedagogical topic knowledge is the expertise needed by teachers to incorporate technology into their instruction in any subject area. By applying the proper pedagogical techniques and technological tools while delivering content, teachers have an intuitive awareness of the intricate interactions between the three basic components of knowledge (CK, PK, and TK).

In this study, technological pedagogical content knowledge refers to the understanding of how pre-service fine arts teachers in primary schools apply technological knowledge, content knowledge, pedagogical knowledge, pedagogical content knowledge, technological pedagogical knowledge, and technological pedagogical content knowledge.





ii. Pedagogical Knowledge (PK)

Pedagogical Knowledge (PK) refers to teachers' knowledge and understanding of general teaching principles and strategies, including instructional design, classroom management, and student assessment (Koehler & Mishra, 2009). In the context of arts education, PK specifically refers to knowledge and understanding of how to teach art concepts and skills effectively, such as lesson planning, scaffolding, and providing feedback (Koster, Brekelmans, Korthagen, & Wubbels, 2005). Operational definition of PK in this study refers to pre-service primary fine arts teachers' understanding and implementation of pedagogical strategies in arts education, as demonstrated through their lesson planning, instructional methods, and student assessment practices.



iii. Technology Knowledge (TK)

Technology Knowledge (TK) refers to the knowledge and skills required for the effective use of technological tools and resources to support teaching and learning. This includes knowledge of various hardware and software applications, as well as the ability to use technology for instructional purposes such as creating and delivering multimedia presentations, designing and implementing online activities, and facilitating online communication and collaboration among students and teachers" (Koehler & Mishra, 2009).





Specifically in the context of arts education, TK involves knowledge and skills related to digital media tools, software applications, and other technology resources that can enhance the creative and expressive capabilities of students, while also supporting the development of critical thinking, problem-solving, and communication skills.

iv. Content Knowledge (CK)

Content Knowledge (CK) can be defined as "knowledge about subject matter and the structure of the subject, including knowledge of the ways in which topics in the subject are related, organized, and represented" (Shulman, 1986, p. 9).



In the context of arts education, CK refers to knowledge of the concepts, skills, and techniques of various art forms, as well as the historical, cultural, and social contexts in which they are created and interpreted. This knowledge includes understanding of the elements and principles of art, the artistic processes of creating and producing works of art, and the critical analysis and interpretation of artworks (Eisner, 2002; Smith-Shank, 2016).

v. Technological Pedagogical Knowledge (TPK)

Technological Pedagogical Knowledge (TPK) refers to the knowledge and understanding of how to integrate technology effectively into teaching practices to enhance student learning outcomes (Mishra & Koehler, 2006). In the context of this study, TPK specifically





refers to the knowledge and understanding of how to integrate technology into the teaching of fine arts in primary education, in a way that supports the development of students' artistic skills and creativity.

For the purposes of this study, Technological Pedagogical Knowledge (TPK) is defined as the knowledge and understanding of how to effectively integrate technology into the teaching of fine arts in primary education, including the use of digital tools and software to support students' artistic development and creativity, as well as the ability to design and implement technology-enhanced learning experiences that are appropriate to students' developmental needs and learning goals.



vi. Pedagogical Content Knowledge (PCK)

Pedagogical Content Knowledge (PCK) is a specialized form of knowledge that encompasses the knowledge of subject matter and the knowledge of pedagogy, which includes knowledge of curriculum, knowledge of instruction, knowledge of assessment, knowledge of students, and knowledge of learning environments. It involves an understanding of how to transform subject matter into forms that are pedagogically appropriate for teaching and learning(Shulman ,1986).

Pedagogical Content Knowledge (PCK) in the context of this study can be defined operationally as the knowledge and skills that pre-service primary fine arts teachers possess





regarding the effective teaching and learning of fine arts concepts and skills in the classroom. PCK involves understanding how to structure and sequence content, create appropriate assessments, identify common student misconceptions, and adapt instruction to meet the needs of diverse learners. PCK is an essential component of effective teaching, as it allows teachers to translate subject matter content into a form that is meaningful and accessible to their students. This definition is consistent with that proposed by Shulman (1986), who first introduced the concept of PCK as a type of knowledge unique to teachers that combines knowledge of subject matter, pedagogy, and students.

vii. Technological Content Knowledge (TCK)



Technological Content Knowledge (TCK) refers to the understanding of how technology can be used to represent, communicate, and support the teaching and learning of subject matter (Mishra & Koehler, 2006).

In the context of this study, TCK of pre-service primary fine arts teachers refers to their knowledge and understanding of how technology can be effectively integrated into the teaching and learning of fine arts content, including the ability to select appropriate technological tools and resources, adapt them to specific instructional contexts, and facilitate students' engagement and learning through technology.





viii. Pre-service teacher

According to the UNESCO International Standard Classification of Education (ISCED), pre-service teachers refer to individuals who are enrolled in teacher education programs and have not yet completed their initial teacher education or certification (UNESCO, 2011). In the Chinese context, pre-service teachers are typically defined as individuals who are studying and certified by the government in a teacher education program at a college or university and have not yet graduated or obtained a teaching license (Wang & Sun, 2020).

ix. Fine arts

According to the National Art Education Association (NAEA), fine arts encompass a range of visual and performing arts, including but not limited to painting, sculpture, drawing, printmaking, design, crafts, photography, video, filmmaking, animation, theater, music, dance, and literature.

Fine arts are typically distinguished from applied arts or decorative arts, which have a functional or utilitarian purpose (such as industrial design or architecture) rather than an aesthetic or expressive one. In this context, fine arts refer to the subject taught in the school.





x. Primary School

Primary school is a term commonly used to describe the first stage of compulsory education in many countries, typically for children aged 5 to 11 years old. The definition may vary depending on the educational system of a specific country or region.(Department for Education, 2019).

In the context of this study, Chinese Primary School refers to the first six years of compulsory education in China, serving students aged six to eleven, and providing basic education in various subjects including Chinese language, mathematics, science, English, social studies, physical education, and fine arts(National Congress,1995).



Specifically, Primary school art subjects are divided into four learning areas:

- a. "Style and Performance" Study subject: Its content includes all art activities related to visual shapes, such as all painting types, sculptures, some manual activities in craftsmanship, labor activities in folk art, etc. Among them, the basic styling elements of art (lines, shapes, space, light and dark, texture, texture, texture, color, composition, etc.).
- b. "Design and Application" Study subject: Its content includes modern design foundation and traditional arts and crafts. Modern design foundations mainly include plane composition, three -dimensional composition, color composition,



industrial design, visual communication design, clothing design, environmental art design, and computer art design. Traditional arts and crafts mainly include basic patterns, metal crafts, bamboo wood crafts, editing crafts, fiber crafts, paper crafts, clay sculptures and ceramics, and various folk art crafts.

- c. "Appreciation and Evaluation" study subject: Its content includes appreciation, identification and review (art comment \ art criticism).
- d. "Comprehensive and Exploration" study subject: Its content includes the field of art learning in artistic learning that guides students to take the initiative to explore, study, create hail, and comprehensively solve problems through comprehensive art activities. There are three levels: integrating the fields of art in art; combining art with other disciplines; and associated with real society. Three -level cross and overlap. In terms of expression, including painting, calligraphy, photography, sculpture, clay sculpture, camera, paper -cutting, design, seal engraving, etc. According to the source of the work, it is divided into classic art and mass art. Table 1.1 below provides an overview of the primary school subjects and their corresponding weekly class hours by grade level, illustrating the structured approach to a well-rounded education that includes both core academic and creative disciplines.

Table 1. 1*Primary school subjects and weekly class hours by grade level*

Subject Category	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6
Moral and Life Education	3	3	-	-	-	-
Moral and Society	-	-	2	2	2	2
Chinese Language	9	9	7	7	6	6
Mathematics	4	4	4	4	4	4
Foreign Language	-	-	2	2	2	2
Science	-	-	3	3	3	3
Music	2	2	2	2	1.5	1.5
Physical Education	4	4	3	3	3	3
Fine Arts	2	2	2	2	1.5	1.5
Integrated Practice	2 - 3	2 - 3	2 - 3	2 - 3	2 - 3	2 - 3

1.9 Contribution Of The Study

The contribution of this study is threefold. Firstly, it provides a comprehensive understanding of pre-service primary fine arts teachers' Technological Pedagogical Content Knowledge (TPACK) in arts education context, which has not been explored thoroughly in the literature. By examining the development of pre-service teachers' TPACK, this study contributes to the existing body of knowledge on TPACK and offers insights into the specific challenges and opportunities that pre-service teachers face when developing TPACK in the arts education context. This study not only fills the gap of TPACK research



in the field of art education, but also further extends the theoretical framework of TPACK so that it can be better applied to scenarios where creativity and technology are combined in art education. By deeply analyzing the interactions between different TPACK domains, this study provides new theoretical perspectives for future research and practice, especially on the question of how technology can support creative expression in art education.

Secondly, this study offers insights into the potential factors that influence pre-service primary fine arts teachers' development of TPACK in arts education context, including their pedagogical content knowledge, technology knowledge, and contextual factors. By identifying these factors, this study provides a basis for developing targeted interventions to support pre-service teachers' development of TPACK in arts education context. This study reveals how specific cultural and geographical factors influence the development of TPACK, especially in the context of basic education in China. These findings provide a basis for developing more targeted interventions, such as designing technology training programs based on regional differences or optimizing teachers' technological pedagogical competencies through the introduction of culturally relevant educational tools.

Finally, this study contributes to the larger conversation on teacher education and curriculum design. By exploring the role of TPACK in arts education, this study highlights the importance of integrating technology into arts education curriculum and pedagogy. The findings of this study can inform the development of future teacher education programs and curriculum design in arts education, with the aim of better preparing pre-service teachers





to use technology effectively and appropriately in their teaching practices. Additionally, the study specifically highlights the importance of introducing interdisciplinary collaboration into arts education programs. By integrating elements from STEM fields into the arts curriculum, such as the combination of geometry and visual arts, the study demonstrated that an interdisciplinary approach can significantly enhance students' creativity and improve their understanding of complex concepts. This integration provides a valuable practical reference for future teacher education program design.

In addition to the outlined contributions, it is important to address the gap in the existing literature and highlight how this study stands apart from previous research endeavors. While prior studies have explored aspects of TPACK in various educational contexts, including STEM subjects, there remains a noticeable void in the literature when it comes to the field of arts education, especially within the realm of pre-service primary fine arts teachers. The unique nature of arts education, characterized by its creative and expressive components, presents distinct challenges and opportunities for integrating technology effectively.

Unlike previous studies that may have focused on broader educational contexts or subject areas, this research specifically targets the domain of arts education and pre-service primary fine arts teachers. By delving into the intricate intersection of technological, pedagogical, and content knowledge within the context of arts education, this study breaks new ground in understanding how technology can be harnessed to enhance creative learning experiences. This specialized focus on arts education is crucial for bridging the





gap between technology and creativity, an area that has not received adequate attention in the existing literature. Unlike previous studies, this study proposes a model for the application of the TPACK framework in art education by carefully analyzing the specific needs of preparatory primary school art teachers. This model is not only applicable to the educational context of China, but also provides a modelable program for other regions with similar cultural backgrounds, providing strong support for art education on a global scale.

Furthermore, this study goes beyond mere exploration by offering actionable insights into the factors influencing the development of pre-service teachers' TPACK in arts education. By identifying the specific challenges and opportunities unique to arts education, this research contributes a practical dimension to the theoretical dissubject on TPACK. These insights are crucial for informing targeted interventions and strategies that can effectively prepare pre-service primary fine arts teachers to navigate the complexities of integrating technology while maintaining the integrity of artistic expression.

The study proposes an approach to reflective practice as a core strategy for teacher training. By guiding teachers to continually evaluate and improve the way they integrate technology and arts instruction in their actual teaching, teachers' deep understanding of the TPACK framework can be enhanced. This model of practice-based training is critical to enhancing the effectiveness of future teachers, especially in the ever-changing technological landscape.

In summary, the contribution of this study not only encompasses a comprehensive





understanding of pre-service primary fine arts teachers' development of TPACK in arts education context but also addresses a notable gap in the literature. By focusing on the specialized area of arts education and offering practical insights into the factors influencing TPACK development, this research advances the dissubject on technology integration within the realm of artistic pedagogy. Through these combined efforts, this study establishes itself as a pivotal piece of scholarship that not only expands our knowledge of TPACK but also fills an important void in the existing literature, setting a new benchmark for understanding and enhancing technology integration in arts education.

1.10 Limitation Of The Study



This study investigates the technological pedagogical content knowledge (TPACK) of pre-service primary fine arts teachers in the arts education context, offering valuable insights. However, certain limitations must be acknowledged to provide a balanced understanding of the findings and their broader applicability.

First, the study was conducted in a specific geographic and cultural context, focusing exclusively on pre-service primary fine arts teachers in one region of China. While the findings provide valuable insights into the TPACK framework in this particular setting, the regional focus limits the generalizability of the results. Education systems, access to technology, and cultural practices vary significantly across regions and countries. For





example, some regions may have greater access to advanced technological tools or emphasize different pedagogical strategies, leading to divergent outcomes in teacher training. Therefore, caution is required when attempting to apply these findings to other contexts. Future research could explore TPACK in diverse cultural and geographic settings, allowing for cross-comparisons and a broader understanding of how regional factors influence TPACK development.

The reliance on self-reported data in this study introduces potential biases that could affect the reliability of the findings. Participants may have consciously or unconsciously provided responses that they believed would be viewed favorably, rather than accurately reflecting their actual knowledge or practices. Additionally, self-reported measures are prone to recall bias, where participants may struggle to accurately remember or articulate their experiences and abilities. These biases could result in overestimations or underestimations of participants' TPACK levels. To address this limitation, future studies could incorporate objective assessment methods, such as classroom observations, video analyses, or performance-based evaluations. Combining self-reports with these methods would provide a more nuanced and accurate understanding of pre-service teachers' technological, pedagogical, and content knowledge.

This study used a cross-sectional design, capturing data at a single point in time. While this approach is useful for identifying associations among variables, it does not allow for the establishment of causal relationships. For instance, it is unclear whether observed





TPACK levels result from the teacher education programs, individual learning efforts, or external influences. The cross-sectional nature also prevents an understanding of how TPACK develops over time or in response to specific interventions. Longitudinal research would address these issues by tracking participants' TPACK development over extended periods, providing insights into how different factors contribute to sustained growth in technology integration and pedagogical strategies.

The use of a quantitative approach, while effective in identifying patterns and general trends, may not fully capture the complexity and depth of TPACK development. Quantitative data often oversimplifies the nuanced interactions between technology, pedagogy, and content knowledge, particularly in an interdisciplinary field like arts education. The richness of participants' lived experiences and the contextual factors influencing their practices may be lost in numerical analyses. Future studies could incorporate qualitative methods, such as in-depth interviews, focus groups, or case studies, to explore participants' perspectives and challenges. Qualitative insights could complement quantitative findings, offering a more holistic understanding of how pre-service teachers develop and apply TPACK in their teaching contexts.

Another significant limitation is the lack of assessment of the quality and content of the teacher training programs that participants underwent. Training programs and curricula likely have a substantial impact on participants' TPACK development, particularly in a field as specialized as fine arts education. Without evaluating these programs, it is challenging





to determine whether observed TPACK levels reflect the effectiveness of training or are influenced by external factors. Future research could analyze the structure, content, and delivery of teacher education programs to identify best practices for fostering TPACK in arts education. Such studies could also examine how different program components—such as hands-on training, exposure to technology, and collaborative projects—affect pre-service teachers' readiness to integrate technology into their teaching.

The study did not account for disparities in access to technological resources among participants. Urban schools and institutions often have better access to advanced tools, infrastructure, and training opportunities compared to their rural counterparts. These disparities likely influence the development of TPACK, as limited access to technology can hinder pre-service teachers' ability to practice and refine their skills. This issue is particularly relevant in the context of arts education, where specialized tools like digital illustration software or virtual reality applications may not be universally available. Future research could investigate the impact of resource disparities on TPACK development, offering strategies for equitably supporting teachers in resource-constrained environments.

Finally, this study exclusively focused on pre-service teachers, which limits the understanding of how TPACK evolves throughout a teaching career. Experienced teachers often refine their technological, pedagogical, and content knowledge through years of classroom practice, professional development, and exposure to changing educational technologies. By excluding in-service teachers, the study provides only a snapshot of





TPACK at an early stage of professional development. Comparative research involving both pre-service and in-service teachers could provide valuable insights into the progression of TPACK over time and identify key factors that contribute to its sustained growth.

In conclusion, while this study offers important contributions to understanding the TPACK of pre-service primary fine arts teachers, several limitations must be considered when interpreting the findings. Addressing these limitations in future research could provide a more comprehensive and nuanced understanding of TPACK development. Such efforts would also inform the design of more effective teacher education programs and policies, ultimately enhancing the integration of technology in arts education.



1.11 Research Structure

There are five chapters in this research project. Chapter 1 introduces the subject-related issues and clarifies the study's fundamental concepts. In Chapter 2, significant constructs to be included in the proposed framework are considered, the hypothesis to be tested is discussed, and a critical evaluation of the pertinent literature in the areas of motivation to teach, career perceptions, and professional identity is provided. The research approach for putting the hypothesis to the test is presented in Chapter 3. The empirical findings resulting from the hypothesis testing are presented and explained in Chapter 4. The key points of the





study are covered in Chapter 5, along with insights from the study's findings, recommendations for additional research, and conclusions.

1.12 Summary

The research-related concerns are introduced in this chapter, which also clarifies the fundamental concepts of the study. This chapter highlights the deficiencies of the existing TPACK literature and highlights the necessity for study on the TPACK of pre-service fine arts teachers. Following that, this chapter provides an overview of the research questions, objectives, research hypotheses, contributions and limitations, operational definition, and general design of the study. The second chapter reviews the body of work and gives a thorough explanation of the theoretical underpinnings and research framework.

