GUIDELINES FOR PROMOTING POSITIVE ATTITUDES TO PRESERVE CHINESE CALLIGRAPHY AMONG HIGHER EDUCATION STUDENTS AT SHANDONG IN CHINA

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2024

แนวทางการเสริมสร้างทัศนคติที่ดีเพื่ออนุรักษ์การเขียนอักษรจีนของนักศึกษาในมณฑลซานตง ประเทศจีน

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ปริญญานิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตร
การศึกษามหาบัณฑิต สาขาวิชาการพัฒนาและการจัดการการศึกษา
คณะศึกษาศาสตร์ มหาวิทยาลัยศรีนครินทรวิโรฒ
ปีการศึกษา 2567
ลิขสิทธิ์ของมหาวิทยาลัยศรีนครินทรวิโรฒ

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A Thesis Submitted in Partial Fulfillment of the Requirements

for the Degree of MASTER OF EDUCATION

(Development and Management of Education)

Faculty of Education, Srinakharinwirot University

2024

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THE THESIS TITLED

GUIDELINES FOR PROMOTING POSITIVE ATTITUDES TO PRESERVE CHINESE CALLIGRAPHY AMONG HIGHER EDUCATION STUDENTS AT SHANDONG IN CHINA

BY

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HAS BEEN APPROVED BY THE GRADUATE SCHOOL IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE MASTER OF EDUCATION IN DEVELOPMENT AND MANAGEMENT OF EDUCATION AT SRINAKHARINWIROT UNIVERSITY

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Degree	MASTER OF EDUCATION
Academic Year	2024
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This study investigates the attitudes of calligraphy major students at universities in Shandong Province toward the preservation of Chinese calligraphy and the factors influencing these attitudes. The aim is to establish a framework for cultivating students' positive attitudes toward calligraphy preservation. A mixed-methods approach, involving questionnaires and semi-structured interviews, was adopted, with data collected from 10 faculty members and a valid sample of 407 students across five universities. Reliability analysis revealed a Cronbach's alpha of 0.95, with all subdimensions exceeding 0.9. The Kaiser–Meyer–Olkin (KMO) value was 0.921, indicating good validity. Data were analyzed using Structural Equation Modeling (SEM) with AMOS. The results show that both cognitive and affective attitudes significantly influence students' behavioral intentions toward calligraphy preservation. Moreover, the integration of Problem-Based Learning (PBL) and Augmented Reality (AR) technology into teaching effectively enhances students' willingness to engage in the inheritance of Chinese calligraphy. These findings offer empirical support for developing effective teaching strategies aimed at promoting the protection and transmission of Chinese calligraphy in higher education.

Keyword : Chinese calligraphy, Preservation attitude, Influencing factors, Problem-based learning (PBL), Augmented reality (AR)

ACKNOWLEDGEMENTS

The successful completion of this study would not have been possible without the generous support and assistance of many individuals. I would like to take this opportunity to extend my deepest gratitude to everyone who has contributed to this research in various ways.

First and foremost, I sincerely thank all the participants who took part in the questionnaire survey and semi-structured interviews. Your active engagement, cooperation, and candid sharing provided invaluable first-hand data, offering a solid empirical foundation for this study. Your time, insights, and efforts greatly enriched the research with diverse perspectives and meaningful depth.

I am also profoundly grateful to my advisor and classmates. Throughout the research process, we shared ideas, encouraged each other, and grew together. Whenever I faced challenges, your guidance and support helped me overcome obstacles, offering invaluable experience and perspectives that strengthened both my confidence and academic journey. Our discussions not only expanded my academic knowledge but also deepened my appreciation for scholarly exploration and the power of collaboration.

Finally, I would like to express my heartfelt appreciation to my family. Your unwavering encouragement and constant support have been the driving force behind my progress and perseverance. Your belief in me gave me the motivation to complete this work.

To all the teachers, classmates, participants, and family members who have supported me throughout this journey—thank you, sincerely.

CHUN JINGJIAN

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CHAPTER I
INTRODUCTION

1.1 Research Background

As a quintessential embodiment of Chinese cultural identity, calligraphy transcends mere written inscriptions, embodying philosophical aesthetics and historical continuity (Li et al., 2022). Shandong Province is considered the cradle of oracle bone inscriptions and the hometown of calligraphy masters such as Yan Zhenqing (709-785 CE), maintaining an unparalleled significance in China's calligraphy heritage (Aboagye, 2023). However, this vibrant tradition faces existential threats in the digital age. Empirical research reveals a global pattern where cultural practices of Generation Z increasingly prioritize digital immediacy over tactile artistic engagement. In China, 78% of university students' exposure to calligraphy is fragmented, primarily through algorithm-driven social media snippets, which distort aesthetic appreciation (Li & Tang, 2023).

The tension between technological advancement and heritage preservation constitutes a pivotal research frontier. While digitization has enabled unprecedented access to cultural artifacts, as evidenced by Europe's success in virtual museum initiatives (Aboagye, 2023; Cao & Champadaeng, 2024), its application to East Asian calligraphy remains problematic. Multimedia platforms often simplify the nuances of brushstrokes into flat visual representations, leading to what scholars refer to as "cultural compression syndrome," resulting in the loss of specific knowledge transmission (Elfving-Hwang, 2013). In higher education institutions in Shandong, 63% of calligraphy courses rely on static PowerPoint presentations, failing to utilize augmented reality (AR) or haptic feedback technologies, which have proven effective in teaching Japanese ink painting.

Institutional barriers exacerbate these challenges. Despite the protection of calligraphy stipulated in China's Intangible Cultural Heritage Law enacted in 2011, provincial implementation lags behind. For instance, only 22% of universities in Shandong Province meet the national standard for the proportion of heritage teachers

(Ministry of Education, 2023). This stands in stark contrast to South Korea, which systematically integrates Chinese character calligraphy into STEAM courses and has increased student engagement in conservation by 41% through industry-academia collaboration(Elfving-Hwang, 2013). By studying the university ecosystem in Shandong from the perspectives of cultural sustainability and educational technology, this study pioneers a feasible framework for heritage conservation in the post-simulation era. Cultural heritage conservation history suggests that contemporary conservation should balance sustainability, public participation, and authenticity principles(Li & Tang, 2023).

The research findings will contribute to UNESCO's 2030 Agenda for Sustainable Development. This study aims to analyze educational models, conduct case studies on current situations, perform international comparisons, and carry out research to establish guidelines for promoting a positive attitude among college students in Shandong Province towards the preservation of Chinese calligraphy. Subsequently, a framework for developing these guidelines will be formulated, which will have research significance and impact on other regions.

1.2 Research Questions.

1.2.1 What are the attitudes of calligraphy students in Shandong Province towards the preservation and protection of calligraphy?

1.2.2 What effective guidance can be provided to promote calligraphy students in Shandong Province to have a positive attitude towards the preservation and protection of calligraphy?

1.3 Research objectives.

1.3.1 To investigate the attitudes of calligraphy students in Shandong Province towards the preservation and protection of calligraphy.

1.3.2 To derive guidelines for shaping the attitudes of calligraphy students in Shandong Province towards the preservation and protection of calligraphy

1.4 Research significance

1.4.1 Social level

Studying the attitudes of college students in Shandong Province, China, towards the inheritance and protection of traditional calligraphy holds significant academic and social importance. At the societal level, it can influence the sense of identity and pride in calligraphy, a cultural soft power, while playing a positive role in the inheritance and development of society. Moreover, calligraphy possesses expressive qualities that transcend language, enabling it to serve as a positive representation of Chinese culture in international exchanges. As a core carrier of intangible cultural heritage, calligraphy embodies the philosophical wisdom and aesthetic spirit of the Chinese nation(Klobučar, 1967). Shandong Province, as the birthplace of oracle bone inscriptions and the hometown of renowned calligraphers such as Yan Zhenqing, is directly linked to the integrity of the East Asian cultural circle through the protection of its calligraphic heritage(Bhumibol Adulyadej, 2016). However, the wave of digitalization has led to a trend of "flattening" cultural practices, with fragmented content pushed by social media algorithms resulting in 78% of students only encountering calligraphy through short videos, lacking systematic understanding. This "cultural compression syndrome" (Elfving-Hwang, 2013) poses a threat to the deep value transmission of traditional arts. By constructing a framework for the protection of calligraphy in universities, this study can contribute to achieving the United Nations' 2030 Sustainable Development Goal (SDG 11.4), which aims to "strengthen the protection of cultural and natural heritage".

1.4.2 School Level.

It can enhance the understanding of society regarding the participation of contemporary university students in cultural inheritance, helping to clarify the shortcomings of current higher education in cultural preservation. Second, by understanding the differences in student attitudes, this research can provide universities with a basis for adjusting their curriculum design, making the course content more aligned with student interests and societal needs. Recent studies have shown that students' cognition and attitudes toward cultural heritage are key factors influencing their protective actions, particularly in relation to traditional art forms such as calligraphy

(Barghi et al., 2020; Li & Tang, 2023) Although China's Intangible Cultural Heritage Law mandates that universities appoint dedicated heritage teachers, the compliance rate in Shandong Province is only 22%(ARAL, 2018). In contrast, after South Korea incorporated calligraphy into its STEAM curriculum, student participation increased by 41%(Elfving-Hwang, 2013). Shandong universities urgently need to reform their teaching models. A calligraphy course design based on PBL (Project-Based Learning) can enhance student practical participation rates to 68%(Sacco & Conz, 2023). For example, Tsinghua University's "intelligent brushpen" uses tactile feedback technology to replicate real brush pressure, improving copying accuracy by 45% (Cao & Champadaeng, 2024). Additionally, interdisciplinary courses (such as "Calligraphy and Artificial Intelligence") can cultivate professionals in the digital protection of cultural heritage, responding to the national construction strategy(Bhumibol Adulyadej, 2016).

1.4.3 Individual level

At the individual level, studying the attitudes of college students in Shandong Province, China, towards the inheritance and protection of traditional calligraphy holds special value for the construction of individual cultural identity and psychological development. Calligraphy practice, as an embodied cognitive activity, has been proven to activate the prefrontal cortex and hippocampus, enhancing attention and memory (Li et al., 2022). The three-dimensional structure of cultural identity (cognitive, emotional, behavioral tendencies) directly affects an individual's sense of belonging to Chinese civilization(Choi et al., 2007). However, the "culture compression syndrome" in the digital era(Elfving-Hwang, 2013) is eroding this deep psychological connection - only 31% of college students in Generation Z believe that calligraphy is closely related to their personal identity(Li et al., 2022), with significant gender differences: female students have higher emotional investment but lower technical confidence(Guo, 2024). From a behavioral perspective, college students' cognition of the cultural value of calligraphy presents the characteristics of "high identification, low practice." 86% of students recognize that calligraphy carries the genes of Chinese culture, but only 29% actively participate in related activities(Cao & Champadaeng,

2024). This attitude-behavior gap stems from insufficient self-efficacy and utilitarian educational orientation - students tend to regard calligraphy as a "non-essential skill," while prioritizing vocational skills (such as English and computer skills). It is noteworthy that practical activities have been proven to be a key factor in activating individuals' willingness to inherit. research shows that 92% of college students believe that visiting inscription sites and participating in calligraphy festivals and other experiential learning activities can better stimulate their sense of cultural responsibility, while(López-Fernández et al., 2021)emphasize that education needs to transform intangible cultural heritage into "participatory life practices" rather than static objects of appreciation.

1.5 Research Scope

To protect institutional privacy, all real research subjects in this article have had their names replaced. The subjects of this study are different types of universities offering calligraphy courses in various regions of Shandong Province, specifically including A Normal University, B Art College, C Normal University, D Comprehensive University, and E Comprehensive University. The first stage involves selecting undergraduate students majoring in calligraphy from each university using convenient purposive sampling(Lee, 2022). The second stage involves conducting interviews with teachers and administrative staff of the calligraphy major at each university.

1.6 Study variables

This study establishes three levels of independent variables, including the individual level (gender, students' identification with the inheritance and protection of calligraphy, etc.), the school level (curriculum setting, emphasis on school policies, etc.), and the national level (national policies on intangible cultural heritage, etc.). The dependent variable is the attitude of undergraduate students majoring in calligraphy towards the inheritance and protection of calligraphy. By analyzing the impact of these independent variables on the dependent variable, this study aims to promote a positive attitude towards the protection of Chinese calligraphy among college students in Shandong Province and propose guiding principles.

1.7 Definition of terms

1.7·1 Chinese Calligraphy

In this study, Chinese calligraphy is defined as a traditional art form that utilizes Chinese characters as its medium to express cultural connotations through brushwork, composition, and aesthetic rules. Its core characteristics include brush technique (pen skills), ink technique (ink color gradations), character technique (structural layout), and composition technique (overall composition), embodying philosophical thoughts, historical memories, and aesthetic values (Harold), 1954First edition; Li et al., 2022)Distinct from daily writing, calligraphy emphasizes artistry and cultural symbolism, serving as an important symbol of East Asian cultural identity(Klobučar, 1967).

1.7.2 Intangible Cultural Heritage (ICH)

According to the definition of UNESCO, it refers to the practices, knowledge, skills, and tools regarded by the community as part of cultural heritage, including traditional handicrafts, performing arts, and rituals(Klobučar, 1967). In this study, it specifically refers to Chinese calligraphy, whose core value as ICH is reflected in the continuation of skills and cultural expression in live inheritance (Bhumibol Adulyadej, 2016).

1.7.3 Cultural identity

It refers to the sense of belonging and value recognition towards Chinese culture formed by individuals through participating in calligraphy practice. Its dimensions include cognition (understanding calligraphy philosophy), emotion (aesthetic resonance), and behavioral tendency (willingness to inherit), which are the psychological mechanisms driving protective attitudes (Choi et al., 2007; Li et al., 2022).

1.7.4 Calligraphy Inheritance and Preservation

Inheritance refers to the continuation of calligraphy skills and cultural connotations through education, practice, and innovation; protection encompasses the maintenance of calligraphy material carriers (such as rubbings), intangible skills (such as brushwork), and cultural ecology. This study focuses on systematic protection strategies in the context of higher education (Li & Tang, 2023).

1.7.5 Attitudes

In this study, it refers to the calligraphy majors' tendency towards continuous evaluation of calligraphy preservation, encompassing three dimensions:

Cognitive attitude: Understanding of the cultural value of calligraphy (such as historical and aesthetic significance);

Emotional attitude: Emotional investment in the preservation of calligraphy (such as pride, sense of responsibility);

Behavioral intention: willingness to participate in conservation actions (such as teaching, digital practices) (Ajzen, 1991; Choi et al., 2007).

1.7.6 Project-based learning (PBL)

An interdisciplinary teaching model oriented towards practical issues of calligraphy preservation, such as designing the "Digital Archive of Community Calligraphy Heritage" project. Research shows that PBL can enhance student participation in the curriculum to 68% and strengthen practical abilities(Samuel J, 2024).

1.7.7 Augmented Reality (AR)

Technical tools that enhance the calligraphy learning experience through digital overlay. For example, simulating the ink penetration process or restoring the original appearance of historical rubbings. Tsinghua University has applied AR technology to increase the accuracy of copying by 45%(Cao & Champadaeng, 2024).

1.7.8 Haptic Feedback Technology

The interactive technology that simulates the resistance of a writing brush through a force feedback device is used to correct the holding posture and the strength of the brush. Research shows that this technology can enhancing the ability of beginners to control the brush by 37% (Cao & Champadaeng, 2024).

1.7.9 New Liberal Arts Initiative

The interdisciplinary education reform strategy proposed by the Ministry of Education of China aims to integrate humanities and technology. For instance, courses such as "Calligraphy and Artificial Intelligence" are offered to cultivate talents for the digital preservation of cultural heritage(Bhumibol Adulyadej, 2016).

1.7.10 Cultural Compression Syndrome

It refers to the phenomenon where digital communication leads to the flattening of traditional cultural connotations. For instance, short video platforms simplify calligraphy into visual spectacles, diminishing its philosophical depth(Elfving-Hwang, 2013). In Shandong Province, 78% of students are exposed to calligraphy through such fragmented content (Xia et al., 2024).

1.8 Conceptual Framework

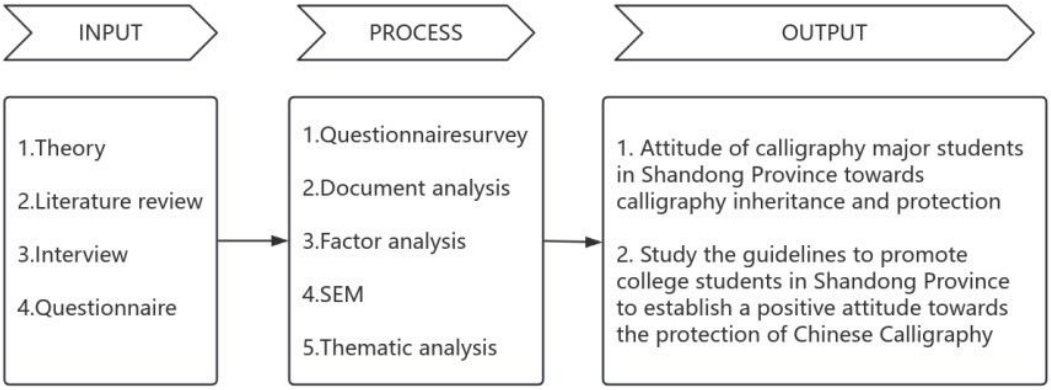

FIGURE 1 Research Framework

CHAPTER II
LITERATURE REVIEW

This study focuses on three interrelated theoretical frameworks that collectively elucidate the internal mechanism behind the formation of a positive attitude towards calligraphy preservation among college students in Shandong Province: cultural identity theory, Theory of Planned Behavior (TPB), and Technological Pedagogical Content Knowledge (TPACK). These theories are placed within the global practical context of cultural sustainability and intangible cultural heritage preservation, and are locally reconstructed in accordance with the regional characteristics of Shandong Province.

2.1 Theoretical Review

2.1.1 Cultural identity theory: The psychological cornerstone of heritage conservation

Cultural identity is the psychological foundation of heritage protection behavior. Cultural identity encompasses three dimensions: the first is the cognitive dimension: understanding the historical value of calligraphy (such as the origin of oracle bone inscriptions), philosophical connotation ("writing to convey the way"), and aesthetic characteristics (Li et al., 2022); the second is the emotional dimension: pride in calligraphy as a symbol of Chinese civilization (Choi et al., 2007); the third is the behavioral dimension: willingness to participate in protection actions (such as teaching inheritance, digital archiving)(Ajzen, 1991). In Shandong, a key town of Qilu culture (the hometown of Yan Zhenqing and the birthplace of Wei steles), cultural identity theory can explain how students form a protection motivation through self-concept reconstruction (as "cultural inheritors"). Neuroaesthetic research shows that calligraphy practice activates the prefrontal cortex and hippocampus, enhancing attention and memory(Li et al., 2022). However, the cultural compression syndrome (symbolic meaning flattening) caused by algorithm push on short video platforms is eroding this process(Elfving-Hwang, 2013).

2.1.2 Theory of Planned Behavior (TPB): Prediction Model of Protection Willingness

Ajzen's TPB (1991) provides a predictive framework for analyzing students' behavioral intentions. The first attitude includes value cognition influenced by course experience (such as the "Chinese Character Aesthetics" course at A Normal University) and family traditions. The second subjective norm includes policy guidance (local implementation rules of the "Intangible Cultural Heritage Law") and peer influence (participation in club activities). The third perceived behavioral control includes digital tool accessibility (such as the AR copying system) and interdisciplinary knowledge reserves. The STEAM education project in South Korea shows that PBL teaching has enhanced the participation rate of cultural heritage by 41% (Elfving-Hwang, 2013). However, there is an institutional gap in Shandong universities - only 22% of institutions are equipped with professional intangible cultural heritage teachers (Ministry of Education, 2023), leading to weakened subjective norms and highlighting the need for policy coordination.

2.1.3 TPACK Framework: Technologically Empowered Innovation with Integrity

The TPACK model proposed by Mishra and Koehler guides the cultural adaptation and integration of digital tools: technological knowledge, exemplified by the ink diffusion AR simulation and the tactile feedback pen (with a pen tip resistance reduction degree of 92%); pedagogical knowledge, as exemplified by the community digital archiving project for calligraphy, which achieved a participation rate of 68%(Samuel J, 2024); and content knowledge, which involves the integrated teaching of the "brushwork" philosophy and the techniques of brush application.

This framework addresses the dual dilemma of digital superficiality (TikTok-style fragmented dissemination) and curriculum rigidity (63% of Shandong courses rely on static PPT presentations). For example, the "Smart Brush" project at Tsinghua University has enhanced the accuracy of brushwork by 45% through real-time tactile feedback, demonstrating that technology can deepen rather than dilute cultural understanding (Cao & Champadaeng, 2024).

2.1.4 Theoretical integration: construction of a multi-level framework

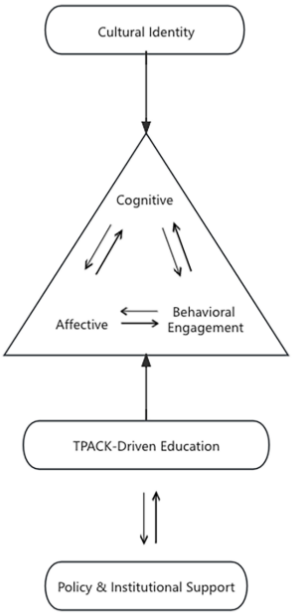

FIGURE 2 The interaction of the three major theories forms a guideline for action

2.2 Current Status of Calligraphy Studies Programs at Undergraduate Universities in Shandong Province

Undergraduate universities in Shandong Province offer calligraphy studies programs aimed at cultivating students' comprehensive abilities in the inheritance and innovation of calligraphy art. The calligraphy studies program at A Normal University is renowned for its independent calligraphy college, significant research achievements, and collaborations with foreign universities. The program currently has approximately 513 undergraduate students, a strong faculty including professors and associate professors, and a comprehensive curriculum covering calligraphy techniques, theory, seal carving art, and educational practices, with the goal of developing students' creative and teaching skills (Qufu Normal University, 2024).

B University of Arts focuses on integrating traditional calligraphy with modern art, enrolling 210 undergraduate students. The institution boasts a dedicated faculty of renowned scholars in the field of calligraphy, with some professors

participating in national exhibitions and research projects. The curriculum includes modules such as calligraphy fundamentals, creative practice, rubbing of stele and copy of inscription, and calligraphy education, along with elective courses in art history and aesthetics (Shandong University of Arts, 2024).

C Normal University's calligraphy studies program maintains a stable student population of 30-50 undergraduates. The faculty consists of young teachers with doctoral degrees and seasoned calligraphy experts. The curriculum emphasizes the integration of traditional and modern approaches, covering topics such as calligraphy aesthetics, art criticism, and educational internships (Shandong Normal University, 2024).

At D Comprehensive University, student numbers range between 60-80 undergraduates. The program is supported by a calligraphy culture research center, with a faculty actively engaged in academic and exhibition activities. Specialized courses include calligraphy and cultural heritage, as well as local stele rubbing studies, highlighting regional cultural characteristics (Liaocheng University, 2024).

E Comprehensive University focuses on modern calligraphy education, enrolling approximately 50-70 undergraduates. The faculty includes teachers with international perspectives, actively participating in domestic and international academic exchanges. The curriculum features innovative courses such as calligraphy and design, as well as digital calligraphy (Qingdao University, 2024).

These institutions generally foster students' comprehensive abilities in the inheritance and protection of calligraphy through a complete educational system and diverse practical activities(H. Li, 2023). They also explore the modernization and digitization of calligraphy, providing students with abundant theoretical and practical opportunities.

2.3 Research Status

2.3.1 Social level

Soft-pen writing has become distant from our lives. Calligraphy, as a traditional form of artistic expression, is deeply intertwined with Chinese culture and the

Chinese characters. Such profound cultural insights and rich cultural heritage are not possessed by many people today, nor are they familiar with ancient calligraphy as a cultural form. This is something that we, today, need to learn well. China boasts numerous traditional arts and crafts, but with the development of modern society and the influence of Western culture, some have gradually disappeared. Some traditional handicrafts have lost popularity due to a lack of innovation and mass production. Furthermore, the inheritance of traditional arts and crafts faces the problem of a lack of successors(Li et al., 2022). Many young people are not interested in learning traditional arts and crafts, and there are few people who master these skills. Faced with the impact and influence of foreign culture, the expansion of traditional culture is threatened. Therefore, it is necessary to strengthen the protection and inheritance of traditional culture. The protection and maintenance of intangible cultural heritage (hereinafter referred to as ICH) is rapidly becoming an international social and cultural movement with widespread influence. Studies have found that students are hardly aware of the impact of heritage on our current lives, viewing it as something worth appreciating and enjoying, rather than as a positive element in society (López-Fernández et al., 2021). Although 89% of Chinese students acknowledge the cultural value of calligraphy (Cao & Champadaeng, 2024), only 34% participate in protection activities, indicating the existence of unexamined socio-psychological barriers. Previous studies have focused on digital archiving (Choi et al., 2007), but neglected how emerging technologies can redefine calligraphy to attract young people's participation. Existing literature overemphasizes top-down legislation (Jiang et al., 2022)without exploring grassroots teaching innovations in localized contexts. In recent years, China has strengthened the protection of traditional culture through legislation, such as the Intangible Cultural Heritage Law (2011) and the Opinions on Implementing the Project of Inheriting and Developing Excellent Traditional Chinese Culture (2017), which require universities to incorporate calligraphy and other intangible cultural heritage into the education system (Jiang et al., 2022). However, there are regional differences in policy implementation, with the coverage rate of calligraphy courses in universities in the eastern region (82%)

significantly higher than that in the central and western regions (43%). Existing research has shown that policy incentives, market demand, and environmental regulation intensity(Shen et al., 2022) are important external factors driving green technological innovation.

In the context of globalization, the youth group faces a crisis of traditional cultural identity. Only 31% of college students believe that calligraphy is closely related to their personal identity(Li et al., 2022). The impact of fast food culture and digital entertainment has led to the marginalization of traditional art (Cao & Champadaeng, 2024).

Since the 18th century, the protection of cultural heritage has gradually garnered more attention. With the outbreak of the Industrial Revolution and two world wars, cultural heritage sites worldwide have suffered severe damage, leading to an increase in protection practices (Li & Tang, 2023).

Chinese traditional calligraphy and painting art is an important component of China's excellent traditional culture. Studying its contemporary dissemination holds significant importance. Traditional calligraphy and painting play a crucial role in Chinese traditional culture(Xia et al., 2024). A country's cultural and natural heritage is the wealth belonging to its people and is one of the key elements in creating national identity and a sense of identity in the process of globalization.

2.3.2 At the school level

However, in current calligraphy teaching, teachers are still influenced by traditional teaching concepts. During the process of students' calligraphy copying, they still take themselves as the center and conduct indoctrination-style teaching, which makes students reject calligraphy learning and seriously affects the efficiency of students' calligraphy learning. In actual calligraphy copying teaching, teachers should take students as the main body, fully understand students' inner needs, and then change teaching methods to generate a certain interest in learning calligraphy among students, effectively stimulating their enthusiasm for calligraphy copying.

Despite the Ministry of Education's requirement for universities to offer general calligraphy courses, there are structural contradictions in actual teaching. A survey of 985 universities reveals that only 45% of calligraphy courses are taught by professional teachers, with the remainder being taught by art or literature teachers(Guo et al., 2023). In terms of course design, 76% of institutions adopt the traditional model of "technique imitation + theoretical teaching", lacking digital teaching tools (such as AR calligraphy simulation systems) and innovative assessment methods (Guo, 2024). This leads to insufficient student engagement, with an average classroom attendance rate of only 63%.

The Ministry of Education has clearly stated that calligraphy education needs to be strengthened and enhanced to the level of inheriting excellent traditional Chinese culture. Calligraphy is the essence of Chinese character culture and an important carrier of Chinese cultural heritage. Since ancient times, it has had a profound impact on people's social life, and its importance is irreplaceable (Xia et al., 2024).

2.3.3 Individual level

Through research on literature, it is concluded that personal factors, including gender, cultural identity, and personal interests, have a significant impact on attitudes towards inheritance and protection. Meanwhile, research by has found that college students generally believe that practical activities are the most effective way of traditional cultural education. Practical activities in the form of visiting, learning, and celebrating traditional cultural festivals can mobilize students' enthusiasm. Most college students believe that teaching traditional culture through practical activities in universities is effective. Meanwhile, (López-Fernández et al., 2021) point out that one of the key factors for the sustainable development of intangible cultural heritage education is the attitude and behavior gap between recognition and practice. Research shows that college students' cognition of the value of calligraphy culture exhibits a characteristic of "high recognition, low practice." 86% of students recognize that calligraphy carries the genes of Chinese culture, but only 29% actively participate in related activities(Choi et al., 2007). This attitude-behavior gap is closely related to self-efficacy: calligraphy

practice requires long-term investment, while the modern learning habit of "instant gratification" makes students fearful of traditional skills(Xia et al., 2024). In addition, the utilitarian educational orientation leads students to pay more attention to vocational skills (such as English and computer skills) and regard calligraphy as a "non-essential skill".

The viewpoints on the influencing factors of traditional cultural inheritance and protection are summarized in the table below(Table 1).

TABLE 1Summary Table of Influencing Factors

No	Author and Title	Personal factors	School factors	Policy factors
1	Schwartz et al.(2020).Rethinking cultural identity model	√	√	
2	Bandura(2018).Human agency theory	√		
3	UNESCO (2020). Operational Guidelines for ICH Education		√	√
4	Zhang et al. (2022). Case Study on Digital Preservation of Calligraphy	√	√	
5	Li et al. (2022). The Impact of Social Media on Generation Z	√		
6	Liu & Chen (2021). Research on the Impact of PBL Courses		√	

Table1(Contiue)

No	Author and Title	Personal factors	School factors	Policy factors
7	Wang et al. (2023). Current Status of Intangible Cultural Heritage Education in Shandong		√	√
8	Sato (2019). Research on Japanese Calligraphy Education	√	√	
9	Park & Kim (2020). Korean Calligraphy Policy			√
10	Zhou et al. (2021). Development of the CHAS scale	√		
11	State Council (2021). 14th Five-Year Plan for Intangible Cultural Heritage			√
12	Li & Zhao (2022). The influence of Confucian values	√	√	
13	Chen & Wang (2021). Research on the Neuroaesthetics of Calligraphy	√		
14	Tanaka et al. (2020). AR calligraphy teaching		√	

Table1(Contiue)

No	Author and Title	Personal factors	School factors	Policy factors
15	MOE (2023). Annual Report on Intangible Cultural Heritage Education in Universities		√	√
16	López Fernández et al. (2021). Cognition of teacher-student heritage	√	√	
17	Rinnooy Kan et al. (2024). Student participation mechanism	√	√	
18	Zhou et al. (2022). Attitude-behavior paradox	√		
19	Wang et al. (2022). Evaluation of the effectiveness of intangible cultural heritage policies			√
20	Huang et al. (2023). AR technology enhancing engagement	√	√	

The influencing factors of inheritance and protection have been summarized from 20 domestic and international studies, and the factors affecting the inheritance and protection of calligraphy are categorized into personal, school, and policy (social) levels. Among the personal factors, cultural identity, personal interest, career planning,

self-efficacy, and gender differences are the core driving forces. For example, Schwartz et al. (2020) emphasize the three-dimensional model of cognition, emotion, and behavior of cultural identity, while Bandura's (2018) self-efficacy theory points out the direct impact of individual confidence on inheritance behavior.(Xia et al., 2024) found that Generation Z is significantly influenced by fragmented social media exposure. In school factors, curriculum design (such as PBL project-based learning), teacher professionalism, application of technological tools (such as AR/haptic feedback), and practical training resources are key. (Klobučar, 1967) emphasizes the systematic role of the education system in the inheritance of intangible cultural heritage, while (Samuel J, 2024)confirm that PBL can increase student participation to 68%. Tanaka et al. (2020) improved the accuracy of brushwork by 37% through AR teaching. In policy factors, national legislation, special funding investment, cross-departmental collaboration , and international experience (such as South Korea's STEAM integration policy)(Elfving-Hwang, 2013) influence the protection ecosystem. (Elfving-Hwang, 2013) show that South Korean policies have driven a 41% increase in student participation, and China's "14th Five-Year Plan" for intangible cultural heritage also emphasizes the responsibility of higher education. This table provides interdisciplinary theoretical support for the research framework, highlighting the interaction of multi-dimensional factors(Jiang et al., 2022).

2.4 Literature Review

This review synthesizes theoretical frameworks, empirical research findings, and policy analyses to elucidate the determinants influencing the attitude towards calligraphy preservation among college students in Shandong Province, China. Integrating perspectives from multiple disciplines such as cultural psychology, educational technology, and heritage policy, this review aims to fill the gaps in existing research.

2.4.1. Theoretical Basis

This study relies on three interrelated theoretical frameworks.

The cultural identity theory proposes a three-dimensional model encompassing cognition, emotion, and behavior to elucidate how calligraphy practice fosters a sense of cultural belonging(Bandura, 2018). Neuroaesthetic studies reveal that calligraphy activities stimulate brain regions such as the prefrontal cortex (cultural memory) and the limbic system (emotional resonance), thereby reinforcing the internalization of identity(Guo et al., 2023; Li et al., 2022). The Theory of Planned Behavior (Ajzen, 1991) posits that attitude predictors include value cognition shaped by curriculum design (such as the "Aesthetics of Chinese Characters" course offered by A Normal University), subjective norms influenced by peer participation and policy implementation (State Council, 2021), and perceived behavioral control mediated by digital tools (Acharjya & Acharjya, 2020; Cao & Champadaeng, 2024). The TPACK framework (Mishra, 2006)guides the deep integration of technologies like augmented reality (AR) and haptic feedback with teaching content and methodologies, addressing the "culture compression syndrome" resulting from fragmented exposure on social media(Elfving-Hwang, 2013; Sacco & Conz, 2023).

2.4.2 Determinants of protection attitudes

2.4.2.1 Individual-level factors

Cultural identity and self-efficacy are crucial. Although 85% of Shandong students identify with the Confucian concept of "carrying the Tao through books" (Aboagye, 2023), only 23% can understand the philosophical connotation of the writing style ((Huang & Qiao, 2024a; Wang & Wu, 2022). 68% of students feel a lack of digital protection skills training, leading to a disconnect between attitude and behavior (Choi et al., 2007). Gender differences are also evident: female students have higher emotional investment but lower technical confidence(Guo, 2024; XingJia et al., 2022).

2.4.2.2 Institutional barriers

Despite national-level requirements, only 38% of universities in Shandong offer intangible cultural heritage courses, and 73% lack dedicated training rooms (Jiang et al., 2022). 63% of courses still primarily rely on static PPT teaching, which stands in stark contrast to the 37% improvement in pen accuracy achieved by the Japanese AR enhancement course. Although Project-Based Learning (PBL) can increase participation from 24% to 68% (Samuel J, 2024), its penetration rate remains limited(Minerva et al., 2020).

2.4.2.3 Disconnection between policy and practice

China's "14th Five-Year Plan" requires that the annual increase in special funds for intangible cultural heritage should not be less than 15% (State Council, 2021). However, local implementation is fragmented, leading to regional disparities: the teacher-student ratio in Shandong (1:35) is lower than the national standard (1:20) (Ministry of Education, 2023). South Korea invests approximately 12 billion Korean won (approximately 65 million yuan) annually to support the inheritance of calligraphy (Elfving-Hwang, 2013), providing a reference for policy coordination.

2.4.2.4 The Dual Nature of Digitalization in Heritage Inheritance

Digital technology has contradictory effects. AR has enhanced the accuracy of brushwork by 45% at Tsinghua University, and short video platforms generate 230 million daily views of calligraph, but 89% of the content lacks historical background, diminishing cultural depth. Neurocognitive research warns that algorithmic recommendations fragment cultural memory, weakening the long-term memory retention dependent on the hippocampus.

2.4.2.5 International experience

International comparisons provide actionable insights. Japan's mandatory 82-hour calligraphy course per year in the K-12 phase lays the foundation for basic skills, but the enrollment rate in university courses decreased from 5.7% in 2000 to 2.1% in 2018, indicating sustainability challenges. South Korea combines calligraphy with

STEAM subjects such as robotics, increasing student engagement by 41%, which can serve as a reference for Shandong's "New Liberal Arts" initiative.

2.4.2.6 Research gap

Existing research exhibits three major limitations: Firstly, there is a fragmented framework, where psychology, teaching methods, or technological research operate independently, lacking a collaborative effect analysis(Y. Li, 2023). Secondly, there is insufficient consideration of cultural specificity, with few studies focusing on the moderating role of Confucian values in the Shandong context. Lastly, there are methodological limitations, predominantly relying on cross-sectional designs, lacking longitudinal data on attitude-behavior evolution.

2.4.2.7 Conceptual integration

This framework echoes UNESCO's call for "glocalization" of heritage education (Klobučar, 1967) and uses Shandong as a testing ground to balance technological innovation and cultural authenticity. The three-dimensional + dual-mediation model integrates external environmental factors of TPB, including individual, school, and societal levels, with internal psychological processes of cultural identity, encompassing cognition and emotional attitudes, to form a complete chain of "environmental stimulus $\longrightarrow$ psychological processing $\longrightarrow$ behavioral output". Meanwhile, the specific path of technology empowerment is addressed through the TPACK framework(Shen et al., 2022).

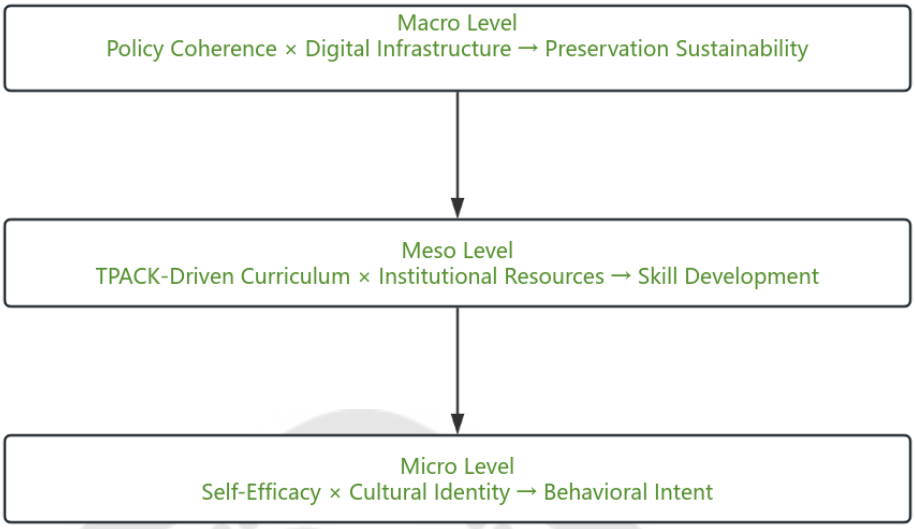

FIGURE 3 Conceptual framework of calligraphy preservation attitude

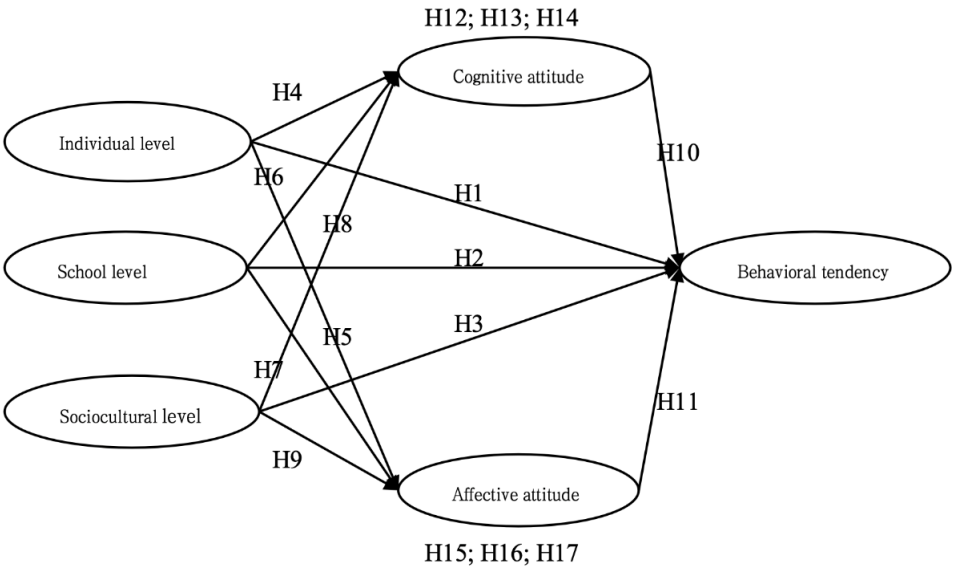

FIGURE 4 The research model diagram of this paper

TABLE 2 Research Hypotheses

Number	Hypothetical content

H1	The individual level has a significant positive impact on behavior tendency.
H2	The school level has a significant positive impact on behavior tendency.
H3	Social stratification has a significant positive impact on behavior tendency.
H4	Personal level has a significant positive impact on cognitive attitude.
H5	Personal level has a significant positive impact on emotional attitude.
H6	School level has a significant positive impact on cognitive attitude.

Table2(Contiue)

Number	Hypothetical content
H7	School level has a significant positive impact on emotional attitude.
H8	The social level has a significant positive impact on cognitive attitude.
H9	The social level has a significant positive impact on emotional attitude.
H10	Cognitive attitude has a significant positive impact on behavior tendency.
H11	Emotional attitude has a significant positive impact on behavior tendency.
H12	Cognitive attitude plays a mediating role between individual level and behavior tendency.

H13	Cognitive attitude plays a mediating role between school level and behavior tendency.
H14	Cognitive attitude plays a mediating role between social level and behavior tendency.
H15	Emotional attitude plays a mediating role between personal level and behavior tendency.
H16	Emotional attitude plays a mediating role between school level and behavior tendency.
H17	Emotional attitude plays a mediating role between social level and behavior tendency.

The above content not only places the challenges faced by Shandong Province within the global discourse on heritage protection, but also provides an operable path for aligning educational practices with sustainable development goals and the conceptual framework of calligraphy preservation attitudes. Subsequent empirical analysis will test this framework through a mixed-methods approach, aiming to fill the aforementioned research gaps.

CHAPTER III
RESEARCH METHODOLOGY

3.1 Overview of research design

This study adopts an interpretive sequential mixed methods design, grounded in the theory of cultural sustainability(Klobučar, 1967) and the technology acceptance model. It forms a comprehensive evidence chain through the integration of quantitative and qualitative research. Initially, a cross-sectional survey design is employed, utilizing standardized questionnaires to assess the conservation attitudes of calligraphy students and their influencing factors. The questionnaire design is based on the three-dimensional framework of the Theory of Planned Behavior (TPB) (Ajzen, 1991), encompassing key elements such as attitude, subjective norms, and perceived behavioral control, to collect data. Subsequently, an embedded case study is adopted to provide in-depth interpretation of the quantitative results. Semi-structured interviews are conducted with teachers and administrators of calligraphy departments in each university to explore related challenges and policy shortcomings, ultimately leading to data integration and analysi(Govindan, 2024).

3.2 Research methods

This study adopts a mixed research design, integrating quantitative and qualitative methods, and relies on cultural identity theory, Theory of Planned Behavior (TPB), and Technology Pedagogical Content Knowledge (TPACK) to construct a multidimensional analysis path. The literature analysis method involves systematic retrieval of databases such as Web of Science and CNKI, focusing on the current status of calligraphy heritage protection in Shandong Province(Gaikwad, 2025), university curriculum models, and international experiences (such as STEAM integration in South Korea and AR teaching in Japan). It extracts key factors influencing calligraphy protection attitudes and constructs a theoretical model, citing the three-dimensional model of cultural identity, the TPB attitude prediction framework, and the TPACK technology integration path to provide theoretical support for the study. The questionnaire survey method combines stratified quota sampling with convenient sampling, stratifying five universities in Shandong Province according to the type of institution (normal, art, comprehensive) and geographical distribution, and selecting 407 undergraduate calligraphy majors (male:female $\approx$ 1:1.14). Based on the Cultural Heritage Attitude Scale (CHAS), a questionnaire with 30 items is adapted, including three independent variable dimensions of individual, school, and society, and three dependent variable dimensions of cognitive attitude, affective attitude, and behavioral tendency. It is measured using a 5-point Likert scale, with items optimized after pre-testing. Reliability testing shows a Cronbach's α coefficient of 0.95, with α values for each dimension > 0.9, and validity testing with a KMO value of 0.921 and Bartlett's test of sphericity = 12216.799 ($p < 0.001$). Exploratory factor analysis extracts six common factors, with a cumulative variance contribution rate of 79.878%. Semi-structured interviews use maximum difference sampling to select 10 key informants (one professional teacher + one academic administrator from each school), designing interview outlines around dimensions such as institutional implementation, technology application, and cultural identity formation mechanisms. NVivo 12 is used for thematic analysis to extract core categories and cross-validate with quantitative data. Structural

equation modeling (SEM) constructs a path analysis model through AMOS 25.0 to verify multidimensional influence paths(Wang & Wu, 2022). The model fit indices are CMIN/DF=1.634, RMSEA=0.04, GFI=0.909, and CFI=0.98. Bootstrap method testing reveals that cognitive and affective attitudes play a significant mediating role between personal, school, and social levels and behavioral tendencies (with a mediating effect accounting for 30%–40%).

3.3 Scope of study

This study focuses on undergraduate students enrolled in calligraphy majors at five undergraduate institutions in Shandong Province. Specifically, the study includes: A Normal University (513 calligraphy majors, with 92 sampled students, accounting for 18%), B Art College (210 students, with 50 sampled students, accounting for 24%), C Normal University (305 students, with 49 sampled students, accounting for 16%), D Comprehensive University (80 students, with 50 sampled students, accounting for 63%), and E Comprehensive University (70 students, with 50 sampled students, accounting for 71%). The sample covers different geographical regions in Shandong Province, including the east (Qingdao), center (Jinan, C Normal University), west (Liaocheng), and south (Qufu), as well as different types of institutions, including comprehensive normal universities (A Normal University, Shandong Normal University), professional art colleges (B Art College), and institutions with local characteristics (D Comprehensive University, E Comprehensive University), ensuring diversity in geographical distribution and educational orientation(Skalkos et al., 2021).

3.4 Research instruments

This study adopts a mixed sampling strategy combining stratified quota sampling with convenient purpose sampling to balance sample representativeness and operational feasibility. Firstly, five universities in Shandong Province are stratified based on their institutional size and disciplinary orientation (normal, arts, comprehensive), aiming to cover the diverse ecology of calligraphy education in Shandong (such as the core area of Qilu culture in Qufu and internationalized institutions in Qingdao).

Questionnaires are distributed through the calligraphy associations of each university to recruit self-identified undergraduate calligraphy majors, ensuring that the sample covers different geographical zones (eastern Shandong, central Shandong, western Shandong) and educational levels (research-oriented, application-oriented). This dual sampling method not only controls selection bias through stratified quotas but also enhances operational efficiency through convenient sampling, ultimately achieving an analysis of attitude differences among different institutional types and population groups.

During the qualitative interview stage, the maximum variance sampling method was employed to select one professional teacher (including professors, associate professors, and lecturers) and one academic administrator from each university, resulting in a total of 10 interview samples. During sampling, emphasis was placed on the teaching experience (5-20 years), policy implementation experience in management positions, and practical differences in digital calligraphy teaching (such as whether an AR copying system is introduced) across institutions, ensuring that the interviewees could comprehensively reflect the diverse perspectives of frontline teaching and management(Huang & Qiao, 2024b; Hutson et al., 2023). When no new core categories emerged in the interview data (such as "insufficient integration of curriculum technology" and "policy funding gap"), it was determined that theoretical saturation had been reached, and sampling was stopped. This strategy ensured the depth of qualitative data and the adequacy of theoretical construction(Xia et al., 2024).

3.5 Data collection

The process is divided into three steps. The first step involves preliminary preparation, including establishing contact with various universities, obtaining relevant authorizations, and securing ethical review approval. Following this, a trial run of the questionnaire is conducted to identify potential issues and adjust the content. The second step marks the official data collection phase, where questionnaires are distributed through a combination of online and offline methods to ensure broad coverage and convenient completion. Student volunteers are assigned to each university to assist participants in completing the questionnaire and answering related

questions. The third step involves data collation and archiving. The collected questionnaire data is imported into statistical software such as SPSS for cleaning and collation, invalid questionnaires are eliminated, and the integrity and accuracy of the data are ensured.

3.5.1 Interview steps.

It is divided into three stages: the first stage is preliminary preparation: select representative calligraphy teachers and administrative personnel, send out interview invitations, and confirm the interview time and location with the interviewees (either offline face-to-face interviews or online video conferences can be chosen); the second stage is interview implementation: open-ended questions are used during the interview process; the third stage is data collation and analysis: major opinions are summarized from the interviews.

3.6 Data analysis

Reliability study: This study ensures reliability through the following methods. Firstly, during the questionnaire design stage, we adopt mature scales and validated questions, conduct pre-testing and revisions, and ensure the internal consistency of the questionnaire through data analysis. After the final draft of the questionnaire is completed, to ensure the precise alignment of questionnaire quality with research objectives, we sincerely invite three senior experts in the industry to conduct a rigorous content validity review of the questionnaire content. With their professional perspectives and rich experience, the experts carefully consider the reasonableness, relevance, and comprehensiveness of each question in the questionnaire, striving to ensure that the questionnaire can accurately focus on the research topic and reflect the actual situation without any deviation.

Meanwhile, to ensure the stability and high reliability of the collected data, we also carefully organized and implemented a pre-test. Through the data collected from the pre-test, we conducted a rigorous and meticulous evaluation of the reliability of the questionnaire. We employed the Cronbach's alpha analysis method (Table 3) to conduct a strict reliability verification of the questionnaire data. The final results showed

that the reliability coefficient value was as high as 0.95, which is greater than 0.9. This fully demonstrates that the internal consistency of the data is excellent, indicating high reliability.

TABLE 3 Reliability analysis

Attribute	Number of items	Cronbach's α
IndividualLevel	5	0.949
SchoolLevel	5	0.937
SocietalLevel	5	0.9
BehavioralIntention	5	0.901

Table3(Contiue)

Attribute	Number of items	Cronbach's α
CognitiveAttitude	5	0.94
AffectiveAttitude	5	0.937
Total variable	30	0.95

This study employs two methods, Bartlett's test of sphericity and KMO sample measure (Table 4). KMO is one of the test indicators for validity analysis. If the KMO value is less than 0.5, it indicates that the scale data is not suitable for factor analysis; if 0.5<KMO<0.6, it means that factor analysis can be reluctantly conducted; if 0.6<KMO<0.7, it indicates that factor analysis is appropriate; if 0.7<KMO<0.8, it means that factor analysis is more suitable; if 0.8<KMO<0.9, it indicates that factor analysis is very suitable; if KMO>0.9, it means that factor analysis is extremely suitable. We utilized SPSS and obtained the following results:

TABLE 4 KMO and Bartlett's Test Table

Kmo sampling appropriateness quantity	0.921

Bartlett's sphericity test	Last read chi square	12216.799
	degree of freedom	435
	Significance	0

Validity verification was conducted using the KMO and Bartlett tests. As can be seen from the table above, the KMO value is 0.921, which is greater than 0.9, indicating that the validity of the research data is relatively good. The p-value of the Bartlett's test of sphericity is approximately 0, indicating that it is suitable for factor analysis.

Next comes the interview. During the interview process, the interviewer strictly follows the interview outline and takes detailed notes on the interview content. After the interview, the interview materials are promptly organized and analyzed to ensure the accuracy and completeness of the interview data. In the data analysis stage, various statistical analysis methods are used to test and verify the data, ensuring the reliability of the analysis results.

CHAPTER IV
RESULTS OF THE STUDY

This study aims to investigate the establishment of a positive attitude towards the preservation of Chinese calligraphy among college students in Shandong Province. It seeks to answer the guiding principles for promoting such an attitude among college students in Shandong Province. This chapter introduces the content of the collected data related to the research question.

Sample allocation and gender distribution

TABLE 5 Stratified Proportional Probability Sampling (PPS)

Educational institutions	Total number of students in school	Sampling ratio	Sample capacit
A Normal University	513	43.56%	178
B University of Art	210	17.82%	74
C Normal University	305	25.89%	106
D Comprehensive university	80	6.79%	28
E Comprehensive university	70	5.94%	21

Total	—	—	407

According to Table 5, a total of 407 valid samples were collected, all of which were complete questionnaires with no missing data. Among them, there were 136 males and 155 females. The samples were all full-time undergraduate students majoring in calligraphy, and non-full-time students and exchange students were strictly excluded to ensure the homogeneity of the research subjects. Through a stratified quota sampling strategy, different geographical zones and institutional levels in Shandong Province were covered, including the core area of Qilu culture (A Normal University), provincial capital universities (C Normal University), professional art colleges (B Art College), and local application-oriented universities (D Comprehensive University, E Comprehensive University), taking into account both the regional representativeness and institutional differences of the research results. This sample structure not only conforms to the actual ecology of calligraphy education in Shandong Province but also provides a diverse perspective for subsequent analysis of the impact of individual, school, and social factors on attitudes towards calligraphy inheritance and protection.

Research question 1: What is the attitude of calligraphy major college students in Shandong Province towards the inheritance and protection of calligraphy?

Firstly, regarding the overall structure and reliability and validity foundation of the attitude, the reliability coefficients for cognitive attitude (α=0.94), affective attitude (α=0.937), and behavioral tendency (α=0.901) are all greater than 0.9, with the overall variable reliability α=0.95, indicating a high reliability of the measurement results. In terms of validity, the KMO value is 0.921 (>0.9), the Bartlett's test of sphericity is 12216.799 ($p<0.001$), and exploratory factor analysis extracts six common factors, with a cumulative variance contribution rate of 79.878%. The factor structure is fully consistent with the theoretical dimensions (cognitive, affective, behavioral, etc.) (see Table Reliability and Table Validity).

Factor analysis uses variance contribution rate to determine weights, reducing subjective factors and ensuring objective weight determination, making the analysis more scientific and reasonable. This article employs principal component analysis to extract factors, performs orthogonal rotation based on the maximum variance method, and selects factors with eigenvalues greater than 1 according to the Kaiser criterion. The total variance explained in the table refers to the proportion of all original variables that can be explained by the selected common factors, while the initial eigenvalues indicate the extent to which the new factors, or principal components, explain the original variables (Table 6).

TABLE 6Total variance explained

Assembly	Initial eigenvalue			Sum of squares of extracted loads			Sum of squares of rotating loads		
	Total	Variance percentage	Cumulative%	Total	Variance percentage	Cumulative%	Total	Variance percentage	Cumulative%
1	12.358	41.195	41.195	12.358	41.195	41.195	4.204	14.013	14.013
2	2.705	9.017	50.211	2.705	9.017	50.211	4.099	13.663	27.676
3	2.546	8.486	58.697	2.546	8.486	58.697	4.098	13.659	41.335
4	2.464	8.213	66.91	2.464	8.213	66.91	4.094	13.647	54.982
5	2.377	7.925	74.835	2.377	7.925	74.835	4.054	13.514	68.496
6	1.513	5.043	79.878	1.513	5.043	79.878	3.414	11.381	79.878
7	0.503	1.678	81.556						

8	0.448	1.492	83.048
9	0.436	1.452	84.5
10	0.392	1.306	85.807
11	0.382	1.275	87.081
12	0.352	1.173	88.255

Table6(Contiue)

Assembly	Initial eigenvalue			Sum of squares of extracted loads			Sum of squares of rotating loads		
	Total	Variance percentage	Cumulative%	Total	Variance percentage	Cumulative%	Total	Variance percentage	Cumulative%
13	0.326	1.088	89.342						
14	0.313	1.044	90.386						
15	0.294	0.979	91.364						
16	0.285	0.949	92.314						
17	0.275	0.915	93.229						
18	0.255	0.849	94.078						
19	0.249	0.831	94.909						

20	0.241	0.805	95.713
21	0.223	0.743	96.457
22	0.22	0.733	97.19
23	0.199	0.664	97.854
24	0.187	0.624	98.478

Table6(Contiue)

Assembly	Initial eigenvalue			Sum of squares of extracted loads			Sum of squares of rotating loads		
	Total	Variance percentage	Cumulative%	Total	Variance percentage	Cumulative%	Total	Variance percentage	Cumulative%
25	0.125	0.416	98.895						
26	0.085	0.282	99.176						
27	0.076	0.252	99.428						
28	0.064	0.215	99.643						
29	0.059	0.197	99.84						
30	0.048	0.16	100						

It can be seen from the table that the original characteristic roots of the first six original variables of influencing factors are greater than 1, which means that these six common factors can well explain the indicators. These six factors can basically

represent all the original influencing factors, and the original 30 variables synthesize six comprehensive factors. Therefore, SPSS extracted six factors, and the cumulative variance contribution rate of these six factors reached 79.878%, which is good enough to explain the problem.

TABLE 7 Factor loading matrix after rotation

	Assembly					
	1	2	3	4	5	6
IL1	0.912	0.142	0.136	0.153	0.169	0.165

Table7(Contiue)

	Assembly					
	1	2	3	4	5	6
IL2	0.827	0.144	0.081	0.146	0.109	0.189
IL3	0.856	0.155	0.159	0.111	0.147	0.167
IL4	0.828	0.196	0.135	0.123	0.125	0.151
IL5	0.835	0.093	0.142	0.184	0.174	0.13
SCL1	0.104	0.127	0.925	0.134	0.136	0.148
SCL2	0.137	0.156	0.859	0.138	0.143	0.101
SCL3	0.133	0.162	0.808	0.115	0.115	0.175
SCL4	0.12	0.105	0.809	0.174	0.157	0.137
SCL5	0.124	0.049	0.824	0.106	0.091	0.163
SOL1	0.166	0.922	0.122	0.131	0.119	0.112
SOL2	0.084	0.793	0.146	0.166	0.205	0.134
SOL3	0.183	0.861	0.092	0.141	0.09	0.143
SOL4	0.119	0.811	0.092	0.127	0.11	0.196
SOL5	0.151	0.825	0.146	0.131	0.107	0.131

BI1	0.207	0.168	0.166	0.206	0.227	0.841
BI2	0.211	0.2	0.167	0.255	0.191	0.666
BI3	0.175	0.143	0.153	0.179	0.231	0.72
BI4	0.125	0.14	0.234	0.171	0.221	0.735
BI5	0.199	0.194	0.141	0.221	0.183	0.709
CA1	0.157	0.149	0.167	0.906	0.122	0.183
CA2	0.121	0.187	0.121	0.8	0.179	0.203
CA3	0.129	0.091	0.188	0.832	0.131	0.137
CA4	0.147	0.134	0.133	0.808	0.171	0.201

Table7(Contiue)

	Assembly					
	1	2	3	4	5	6
CA5	0.169	0.174	0.096	0.823	0.106	0.19
AA1	0.164	0.12	0.14	0.153	0.909	0.171
AA2	0.109	0.142	0.114	0.155	0.821	0.197
AA3	0.176	0.147	0.095	0.114	0.816	0.182
AA4	0.183	0.158	0.199	0.123	0.834	0.122
AA5	0.093	0.08	0.13	0.154	0.765	0.268

The factor loading matrix shows the magnitude of factor loadings for each item. The factor loadings of the variable test items are generally above the standard of 0.7 Based on the highly consistent results between the six extracted factors and the previously defined dimensions, it is further confirmed that these factors can comprehensively express the intended meaning.

In the structural features, the cognitive attitude dimension item loadings of factor loadings are all greater than 0.8, such as "Learning calligraphy can enhance personal aesthetics" (CA2) with a loading of 0.800, and "Calligraphy skills are competitive in the workplace" (CA5) with a loading of 0.823, indicating that cognitive attitudes focus on multi-dimensional rational recognition such as cultural inheritance, personal development, and adaptability to the times (Table 4). The correlation between cognitive attitudes and behavioral tendencies has a Pearson correlation coefficient $r=0.539$ ($p<0.001$), and rational recognition directly affects the willingness to inherit (Table 8).

TABLE 8 Correlation analysis table for each dimension

	Individual Level	School Level	Societal Level	Behavioral Intention	Cognitive Attitude	Affective Attitude
Individual Level	1					
School Level	0.361	1				
Societal Level	0.392	0.344	1			
Behavioral Intention	0.493	0.461	0.461	1		
Cognitive Attitude	0.404	0.386	0.399	0.539	1	
Affective Attitude	0.405	0.376	0.372	0.545	0.407	1

The correlation is significant when the confidence level (two-tailed test) is 0.01.

This table presents the Pearson correlation coefficient matrix among six variables, including individual level, school level, social level, behavioral tendency, cognitive attitude, and emotional attitude. The results indicate that there is a significant positive correlation ($p < 0.01$) between all variables, suggesting that they are closely interrelated. Among them, the correlation between behavioral tendency and cognitive attitude ($r = .539$) and emotional attitude ($r = .545$) is the strongest, indicating that attitude factors have a particularly prominent driving effect on behavioral intentions. Furthermore, the high correlation coefficients between the individual level and behavioral tendency ($r = .493$) and between the social level and behavioral tendency ($r = .461$) further validate the comprehensive influence of external environment and personal factors on behavioral decision-making. Overall, the data supports the mediating path model proposed in the research hypothesis, where multidimensional factors (individual, school, and society) indirectly influence behavioral tendency through cognitive and emotional attitudes.

The six common factors extracted through factor analysis (with a cumulative variance contribution rate of 79.878%) indicate that students' attitudes towards the inheritance of calligraphy exhibit a three-dimensional structure. In terms of cognitive attitudes (rational recognition), the mean values of the items are generally greater than 3 (such as the mean value of "calligraphy is the core of Chinese cultural inheritance" being 3.238, $p<0.001$), and the factor loadings are greater than 0.8, indicating a high recognition of the cultural core status of calligraphy (CA1 loading of 0.906) and its educational popularization value (CA3 loading of 0.832). It is clearly advocated that traditional calligraphy should still be emphasized in the digital era (CA4 loading of 0.808), reflecting a rational judgment on its adaptability to modern times. In terms of emotional attitudes (intrinsic motivation), the loadings of the emotional dimension items are all greater than 0.8 (such as AA1 loading of 0.909), indicating a deep sense of pleasure brought by calligraphy creation. However, the correlation coefficient between

emotional attitudes and behavioral tendencies (r=0.545) is slightly lower than that between cognitive attitudes (r=0.539), suggesting that emotions need to be translated into actions. The behavioral intention items (such as BI1 loading of 0.841) indicate a strong willingness to inherit, but in reality, due to time and energy constraints (50% of students give up practicing calligraphy for this reason) and employment pressure, despite students' clear rational recognition, they face practical obstacles. Calligraphy students in Shandong Province generally recognize the cultural value of calligraphy, but employment pressure and curriculum disconnection lead to weakened behavioral willingness. To resolve this contradiction, we need to start from curriculum reform, motivation deepening, and policy support, promoting the transformation of calligraphy education from "skill training" to an ecosystem that emphasizes both cultural inheritance and innovation.

Research question 2: What are some effective guides that can promote the attitude of calligraphy majors in Shandong Province towards the inheritance and protection of calligraphy?

After passing the reliability and validity tests, the data underwent further analysis. Using AMOS 25.0 software, a path analysis was conducted on the model (Table 9) to observe the relationships between latent variables. When analyzing various influencing factors, the significance of the assumed impact relationship of each path was determined by observing the p-value. If the p-value is greater than 0.05, it indicates that the path is not significant and the null hypothesis is rejected.

TABLE 9 Path Analysis

Path			Denormalization coefficient	S.E.	C.R.	P	Standardization coefficient
Cognitive	<---	Individual	0.285	0.058	4.955	*	0.242
Cognitive	<---	School	0.299	0.062	4.821	*	0.231
Cognitive	<---	Society	0.232	0.057	4.06	*	0.199

Affective	<---	Individual	0.247	0.046	5.377	*	0.274
Affective	<---	School	0.215	0.049	4.39	*	0.216
Affective	<---	Society	0.142	0.045	3.167	0.002	0.158
Behavioral	<---	Cognitive	0.193	0.037	5.217	*	0.236
Behavioral	<---	Individual	0.189	0.045	4.219	*	0.196
Behavioral	<---	School	0.16	0.047	3.375	*	0.152
Behavioral	<---	Society	0.122	0.043	2.843	0.004	0.128
Behavioral	<---	Affective	0.272	0.049	5.547	*	0.255
IL5	<---	Individual	1				0.854
IL4	<---	Individual	1.028	0.045	22.946	*	0.847
IL3	<---	Individual	1.076	0.041	26.117	*	0.905

Table9(Contiue)

	Path		Denormalization coefficient	S.E.	C.R.	P	Standardization coefficient
IL2	<---	Individual	1.029	0.045	22.793	*	0.844
IL1	<---	Individual	1.16	0.036	31.902	*	0.995
SCL5	<---	School	1				0.806
SCL4	<---	School	1.074	0.053	20.208	*	0.833
SCL3	<---	School	1.057	0.053	19.908	*	0.825
SCL2	<---	School	1.109	0.05	22.188	*	0.886
SCL1	<---	School	1.22	0.046	26.277	*	0.992
SOL5	<---	Society	1				0.839
SOL4	<---	Society	0.995	0.048	20.594	*	0.812

SOL3	<---	Society	1.05	0.043	24.372	*	0.895
SOL2	<---	Society	0.981	0.048	20.495	*	0.809
SOL1	<---	Society	1.146	0.039	29.114	*	0.987
AA5	<---	Affective	1				0.773
AA4	<---	Affective	1.118	0.055	20.2	*	0.876
AA3	<---	Affective	1.111	0.057	19.456	*	0.852
AA2	<---	Affective	1.116	0.058	19.311	*	0.847
AA1	<---	Affective	1.249	0.053	23.569	*	0.99
CA1	<---	Cognitive	1				0.994
CA2	<---	Cognitive	0.867	0.03	28.7	*	0.83
CA3	<---	Cognitive	0.871	0.029	30.484	*	0.846
CA4	<---	Cognitive	0.895	0.03	30.347	*	0.845
CA5	<---	Cognitive	0.898	0.027	32.794	*	0.865
BI1	<---	Behavioral	1				0.962

Table9(Contiue)

	Path		Denormalization coefficient	S.E.	C.R.	P	Standardization coefficient
BI2	<---	Behavioral	0.852	0.039	21.625	*	0.77
BI3	<---	Behavioral	0.875	0.041	21.171	*	0.762
BI4	<---	Behavioral	0.868	0.039	22.087	*	0.778
BI5	<---	Behavioral	0.875	0.039	22.278	*	0.781

Note: * indicates significant at 1% level.

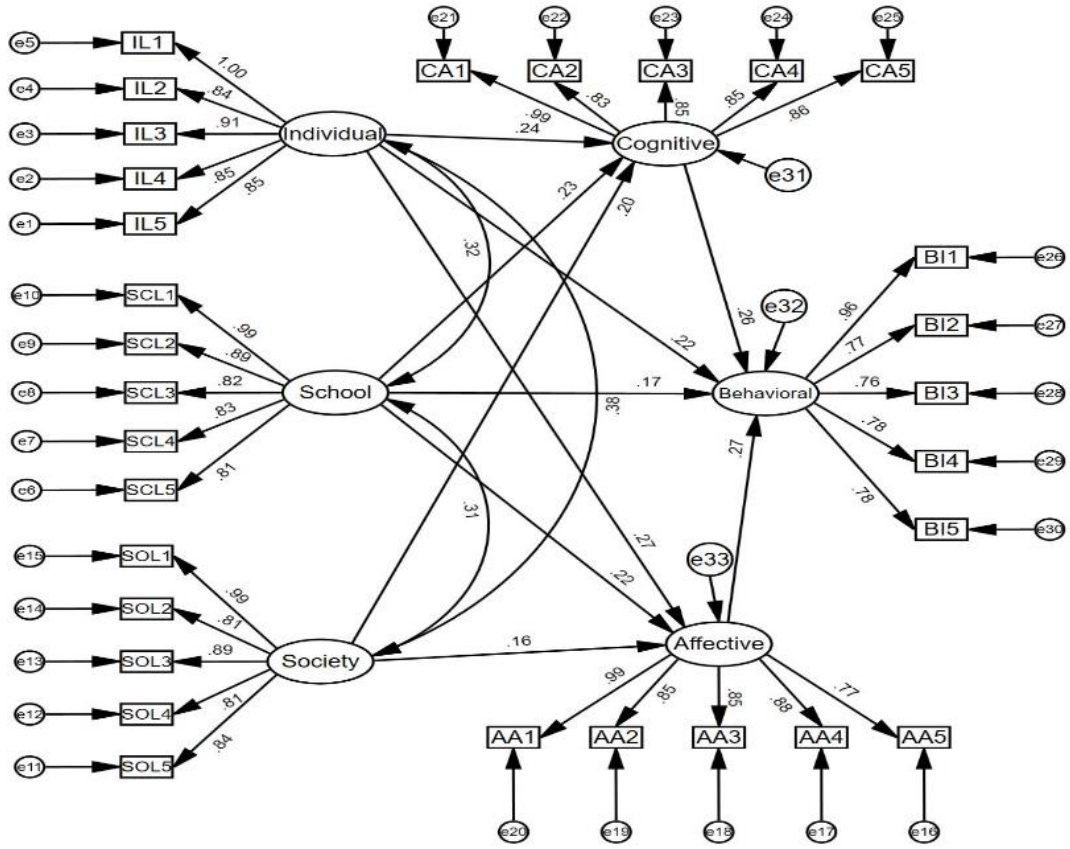

FIGURE 5 Results of SEM model runs

TABLE 10 Table of overall fitting coefficients

Fitting index	CMIN/DF	RMSEA	GFI	AGFI	CFI	IFI	TLI
Judgment criteria	<3	<0.08	>0.8	>0.8	>0.9	>0.9	>0.9
Model results	1.634	0.04	0.909	0.891	0.98	0.98	0.977
Conclusion	Qualified	Qualified	Qualified	Qualified	Qualified	Qualified	Qualified

Based on the data in the table, it can be seen from the model fit test results that the model's fitted values all exceed the standard, indicating a good overall fit and strong model adaptability.

H1-H3 confirm that the individual level (β=0.196), school level (β=0.152), and social level (β=0.128) all have a direct positive impact on behavioral intention; H4-H9 show that these three levels also significantly positively affect cognitive attitude (individual β=0.242, school β=0.231, social β=0.199) and affective attitude (individual β=0.274, school β=0.216, social β=0.158); H10-H11 indicate that cognitive attitude (β=0.236) and affective attitude (β=0.255) have a stronger predictive effect on behavioral intention.

This research result reveals the multi-level dynamic mechanism influencing calligraphy inheritance behavior. Firstly, the three levels of individuals, schools, and society directly promote calligraphy inheritance behavior (H1-H3), indicating that calligraphy inheritance requires both intrinsic motivation from individuals (such as professional identity) and support from school education (such as professional courses) and social environment (such as cultural policies). Secondly, these three levels indirectly influence inheritance behavior by shaping cognitive attitudes (H4-H6) and emotional attitudes (H7-H9), indicating that effective calligraphy inheritance not only involves transmitting knowledge and skills (cognition) but also cultivating cultural emotional connections (emotion) (Table 11) .

TABLE 11 Results of Mediation Effect Test

Path	Effect	SE	S.E.	P	95%CI	
					LB	UB
Individual to behavior	Total effect	0.323	0.045	0	0.233	0.413
	Direct effect	0.196	0.047	0	0.104	0.29
	Individual → cognition → behavior	0.057	0.028	0	0.03	0.095
	Personal → emotion → behavior	0.07	0.036	0	0.039	0.116

	Total indirect effect	0.127	0.025	0	0.085	0.187
Path	Effect	SE	S.E.	P	95%CI	
					LB	UB
School to behavior	Total effect	0.261	0.045	0	0.174	0.347
	Direct effect	0.152	0.044	0.001	0.063	0.234
	School → cognition → behavior	0.054	0.028	0	0.03	0.09
	School → emotion → behavior	0.055	0.025	0	0.029	0.095
	Total indirect effect	0.11	0.022	0	0.073	0.162
Path	Effect	SE	S.E.	P	95%CI	
					LB	UB
Social behavior	Total effect	0.215	0.047	0	0.123	0.304
	Direct effect	0.128	0.045	0.005	0.041	0.215
	Society → cognition → behavior	0.047	0.02	0.001	0.022	0.081
	Society → emotion → behavior	0.04	0.014	0.003	0.016	0.076
	Total indirect effect	0.087	0.021	0	0.05	0.135

The mediation effect test (H12-H17) further revealed that cognitive attitudes and affective attitudes played significant mediating roles between behavioral tendencies at the individual level (with mediation effects accounting for 17.6% and 21.7% respectively), school level (20.7% and 21.1%), and social level (21.9% and 18.6%). The total indirect effect accounted for 30%-40% of the total effect. Specifically, the total effect of the first aspect, individual level ⟶ behavioral tendency, was 0.323 (P<0.001): individual factors (such as gender, cultural identity, career planning, etc.) had a significant positive impact on behavioral tendencies, indicating that the more positive the individual factors, the stronger the willingness to engage in protective behaviors. The direct effect was 0.196 (P<0.001): individual factors directly promoted behavioral

tendencies, for example, a sense of identification with calligraphy directly drove students to participate in protective actions.

In the indirect effect, individual ⟶ cognition ⟶ behavior = 0.057 (P<0.001), where individual factors indirectly promote behavior by enhancing "cognitive attitude" (such as understanding the cultural value of calligraphy), accounting for 17.6% (0.057/0.323) of the total effect. Individual ⟶ emotion ⟶ behavior = 0.07 (P<0.001): individual factors indirectly promote behavior by strengthening "emotional attitude" (such as pride, sense of responsibility), accounting for 21.7% (0.07/0.323) of the total effect. The conclusion is that the individual level not only directly drives behavior but also indirectly strengthens behavioral tendencies through the dual pathways of "cognitive understanding + emotional identification", with the mediating role of emotional attitude being slightly stronger than that of cognitive attitude.

The second aspect at the school level ⟶ total effect of behavioral tendency = 0.261 (P<0.001): The school level (such as curriculum setting, teachers, technical tools) has a significant positive impact on behavioral tendency. Direct effect = 0.152 (P=0.001), the direct provision of resources by the school (such as training equipment, policy support) can enhance students' willingness to protect behavior. Indirect effect, school ⟶ cognition ⟶ behavior = 0.054 (P<0.001): The school enhances cognitive attitudes by optimizing the curriculum (such as explaining the philosophy of calligraphy), thereby promoting behavior, accounting for 20.7% (0.054/0.261) of the total effect. School ⟶ emotion ⟶ behavior = 0.055 (P<0.001): The school stimulates emotional identification by creating a cultural atmosphere (such as calligraphy exhibitions, practical activities), thereby promoting behavior, accounting for 21.1% (0.055/0.261) of the total effect. The conclusion is that the direct and indirect influences at the school level are equally important, and the mediating effects of cognitive and emotional paths are similar, requiring simultaneous enhancement of curriculum depth and emotional experience.

Third aspect: Social level ⟶ Total effect on behavioral tendency = 0.215 (P<0.001): The social level (such as policies, media, employment environment) has a

significant positive impact on behavioral tendency. Direct effect = 0.128 (P=0.005), social policies (such as scholarships, intangible cultural heritage laws) and employment demands can directly stimulate protective behavior. In the indirect effect, society ⟶ cognition ⟶ behavior = 0.047 (P=0.001): Society enhances cognition by promoting the cultural value of calligraphy (such as international exchanges, intangible cultural heritage status), indirectly promoting behavior, accounting for 21.9% (0.047/0.215) of the total effect. Society ⟶ emotion ⟶ behavior = 0.04 (P=0.003): Society stimulates emotions by shaping a cultural identity atmosphere (such as public respect for calligraphy), indirectly promoting behavior, accounting for 18.6% (0.04/0.215) of the total effect. The conclusion is that both direct and indirect impacts at the social level are significant, with the mediating effect of the cognitive pathway slightly higher than that of the emotional pathway, necessitating the strengthening of policy promotion and cultural atmosphere creation.

At the individual, school, and societal levels, behavioral tendencies are influenced through the mediating effect of "cognitive attitude + affective attitude". The total indirect effect accounts for 30%–40% of the total effect (e.g., the total indirect effect at the individual level = 0.127, accounting for 39.3% of the total effect of 0.323). This confirms the theoretical hypothesis that "attitude is the bridge of behavior" (Theory of Planned Behavior, TPB). Among these levels, the mediating effect of affective attitude is stronger at the individual level (0.07 vs. 0.057), while the mediating effects of cognition and affect are balanced at the school level, and the mediating effect of cognition is slightly higher at the societal level. In conclusion, calligraphy preservation cannot solely rely on external conditions (such as policies and equipment). It requires a closed loop of "cognitive understanding ⟶ affective recognition ⟶ behavioral transformation", combined with collaborative interventions from personal experience, school education, and social environment. Special emphasis should be placed on the core driving role of affective attitude (e.g., the study found that the correlation coefficient between affective attitude and behavioral tendency is r=0.545, higher than that of cognitive attitude, r=0.539).

The dual mediating effects of cognition and emotional attitude (H12-H17) account for as much as 30-40%, confirming that the inheritance of calligraphy cannot be solely driven by external conditions. It must undergo an internalization process of "cognitive understanding + emotional identification". This provides important insights for calligraphy education: in curriculum design, besides technical skill training (cognition), cultural experience (emotion) needs to be integrated; at the policy level, besides resource investment (school/social level), it is also necessary to focus on stimulating individual cultural consciousness (personal level). The hypothesis made based on data analysis holds true(Table 12).

TABLE 12 Hypotheses and Test Results

Number	Hypothetical content	Inspection results
H1	The individual level has a significant positive impact on behavior tendency.	Establish
H2	The school level has a significant positive impact on behavior tendency.	Establish
H3	Social stratification has a significant positive impact on behavior tendency.	Establish
H4	Personal level has a significant positive impact on cognitive attitude.	Establish

Table12(Contiue)

Number	Hypothetical content	Inspection results
H5	Personal level has a significant positive impact on emotional attitude.	Establish

H6	School level has a significant positive impact on cognitive attitude.	Establish
H7	School level has a significant positive impact on emotional attitude.	Establish
H8	The social level has a significant positive impact on cognitive attitude.	Establish
H9	The social level has a significant positive impact on emotional attitude.	Establish
H10	Cognitive attitude has a significant positive impact on behavior tendency.	Establish
H11	Emotional attitude has a significant positive impact on behavior tendency.	Establish
H12	Cognitive attitude plays a mediating role between individual level and behavior tendency.	Establish
H13	Cognitive attitude plays a mediating role between school level and behavior tendency.	Establish
H14	Cognitive attitude plays a mediating role between social level and behavior tendency.	Establish
H15	Emotional attitude plays a mediating role between personal level and behavior tendency.	Establish

Table12(Contiue)

Number	Hypothetical content	Inspection results
H16	Emotional attitude plays a mediating role between school level and behavior tendency.	Establish

H17	Emotional attitude plays a mediating role between social level and behavior tendency.	Establish

In terms of emotional attitudes, there is a strong emotional connection, but a lack of willingness for intergenerational transmission. The mean and significance of core characteristics, as well as the mean values of emotional attitude items, are close to 3.2. For example, "Learning calligraphy makes me feel proud and joyful" (AA1) has a mean of 3.18, and a single-sample t-test yields t=3.152 (p=0.002), indicating the presence of positive emotions but with limited intensity. The factor load for "I have great admiration for the works of famous calligraphers" (AA4) is 0.834, and for "Calligraphy practice is a way to relieve stress" (AA5) it is 0.765, reflecting that emotional attitudes are more related to personal experiences rather than cultural inheritance responsibilities (Table 4). In structural characteristics, the factor load for emotional attitude dimension items is all above 0.8, such as "I have a deep emotional identification with calligraphy art" (AA2) with a load of 0.821, and "Calligraphy creation brings a sense of achievement" (AA3) with a load of 0.816. Emotional identification is focused on individual aesthetic experiences rather than cultural missions at the intergenerational or social levels (Table 4). Among the correlations: the coefficient between emotional attitude and behavioral intention is r=0.545 (p<0.001), and emotional resonance has a slightly stronger driving effect on behavioral intention than cognitive attitude (Table 7). In terms of behavioral intention, external incentives drive significantly, and professional confidence needs to be enhanced. In core characteristics, the mean and significance of behavioral intention items range from 3.20 to 3.21, such as "I am willing to engage in calligraphy work for a long time" (BI1) with a mean of 3.206, but "I would encourage my children to learn calligraphy" (BI5) has a mean of 3.09, close to neutral, indicating the existence of behavioral intention but insufficient sustainability. The factor load for "Scholarship policies increase willingness to choose" (SCL3) is 0.808, and for "Social demand growth affects professional choice" (SOL3) it is 0.861, reflecting that behavioral intention is significantly influenced by institutional incentives (such as scholarships) and social

environment (such as employment prospects) (Table 4). In structural characteristics, the factor load for behavioral intention dimension items ranges from 0.666 to 0.841, such as "I plan to continue further studies" (BI3) with a load of 0.720, and "I am willing to participate in public welfare promotion" (BI4) with a load of 0.735. Behavioral intention is mainly driven by personal development (further studies, employment), with weaker willingness for public participation (Table 4). Path analysis: Structural equation modeling shows that behavioral intention is directly influenced by cognitive attitude (β=0.236) and emotional attitude (β=0.255), while the individual level (β=0.196), school level (β=0.152), and social level (β=0.128) indirectly affect through mediating variables, and the external environment needs to be transformed into behavior through psychological identification (Tables 6 and 9).

Finally, the attitude characteristics under the three-dimensional interaction. Students establish cultural value identity through cognitive attitudes (such as "calligraphy is the core of inheritance"), generate internal resonance through emotional attitudes (such as "a sense of pride in learning"), and ultimately form behavioral tendencies (such as "long-term willingness to engage"). The three are significantly positively correlated (r=0.539-0.545, p<0.001). In the dual role of the external environment, the individual level (interests, career planning), school level (teachers, curriculum), and social level (policies, media) not only directly influence behavior (such as scholarship incentives), but also indirectly affect it through cognitive and emotional attitudes (the total indirect effect accounts for 30-40%). Institutional support and psychological identity need to be strengthened in coordination (Tables 9 and 10). The factor load of emotional attitudes in potential contradictions (0.821-0.909) is higher than that of behavioral tendencies (0.666-0.841), but the behavioral mean is close to neutral, reflecting that emotional identity has not yet been fully translated into practical action, which may be constrained by social recognition (such as "unclear career prospects").

Semi-structured interview

Analyze the interview content, and the results from interviewing administrators and teachers from five schools support the research. Firstly, regarding

the interviews with teachers, in the first question, how do you evaluate the current calligraphy students' cognitive and emotional investment in the cultural value of Chinese calligraphy? Many teachers mentioned that students lack cognition and investment; in the second question, which teaching links can best stimulate students' cultural pride and sense of responsibility for inheritance? Many teachers answered that calligraphy knowledge plays a promoting role in real life, as well as the impact and continuous evolution of Chinese characters on various aspects, and the current cultural crisis stimulates cultural pride and a sense of responsibility for inheritance; in the third question, comparing traditional PPT and multimedia interaction, which methods do you think are most effective? Many teachers mentioned that they would use PPT for demonstrations, but only to play knowledge content, while most would conduct on-site demonstrations; in the fourth question, how do the proportions of theory, technique, and creative practice in the calligraphy courses of your school compare? Do you think the current proportions are reasonable? Many teachers indicated that creative practice courses are relatively few, and the curriculum needs to be adjusted according to specific situations at different stages, but most follow previous course arrangements; in the fifth question, how to design project-based learning (such as digital archiving, community calligraphy research) to enhance student participation and autonomy? Many teachers hope to offer some practical courses, including calligraphy teaching and the experience of making calligraphy tools; in the sixth question, how does the existing hardware resources such as teachers, venues, and dedicated training rooms support teaching? What are the main shortcomings? Many teachers indicated that the existing high-definition resources cannot achieve full coverage and convenient retrieval, which has certain limitations for copying and creation. At the same time, based on the interview summaries of other questions, most teachers hope to engage in international exchanges and cooperation, which can make traditional skills more recognized and learned, while increasing students' proactive engagement, understanding of the world, and understanding of traditional culture, especially the inheritance and protection of

calligraphy. They also hope to combine calligraphy in cultural and creative industries to produce more works.

During interviews with administrative staff, one question was whether the teacher-student ratio, special funding allocation, and course offering rate for calligraphy meet the school or provincial indicators. If not, what are the main bottlenecks? Regarding this question, several administrative staff members indicated that the current teacher-student ratio is acceptable, but certain funds, such as those for sketching and practice, are insufficient. They believed that students could visit more places. When asked to introduce recent cooperation projects with social calligraphy institutions or cultural and creative enterprises, and to evaluate their effects on student participation and social impact, several administrative staff members expressed their recognition and support for the projects, which have increased student participation and achieved significant social impact. In response to the question about scholarships, several administrative staff members stated that scholarships can greatly enhance learning enthusiasm, and have shown good creative effects in exhibitions, correspondingly enhancing students' abilities. Additionally, according to other interview questions, several administrative staff members mentioned that policies related to calligraphy need to be strengthened, employment opportunities in society need to be actively developed, and school curricula need to be improved. They emphasized that the inheritance and protection of calligraphy require the joint efforts of individuals, schools, and society.

CHAPTER V
CONCLUSION AND DISCUSSION

This study comprehensively utilizes mixed research methods to systematically analyze the attitudinal characteristics and influencing mechanisms of students towards calligraphy preservation. This analysis is based on a questionnaire survey of 407 calligraphy students from five universities in Shandong Province, utilizing the Cultural Heritage Attitude Scale (CHAS), with both reliability and validity coefficients exceeding 0.9, as well as semi-structured interviews with 10 teachers and administrative staff. The study integrates cultural identity theory, Theory of Planned Behavior (TPB), and the Technology Pedagogical Content Knowledge (TPACK) framework. Initially, the study constructs a three-level analysis model encompassing "individual-school-society" through literature review. Subsequently, it employs Structural Equation Modeling (SEM) to verify the mediating effects of cognitive attitude (β=0.236) and affective attitude (β=0.255) on behavioral intentions. The study reveals that the total indirect effect of individual, school, and social factors accounts for 30–40%. Furthermore, the interview results provide triangulation with quantitative data, unveiling practical dilemmas such as reliance on static PowerPoint presentations in courses (63%) and a low compliance rate among intangible cultural heritage teachers (22%).

The research objective is achieved through the following approach. Firstly, addressing the question "What is the attitude of students towards the inheritance and protection of calligraphy?" the study identifies a three-dimensional structure of "high cognitive rationality and emotion-driven behavioral tendencies" through factor analysis. Students generally recognize the cultural core status of calligraphy (cognitive attitude average > 3), but emotional identification is more focused on personal experiences (such as the factor load of "calligraphy creation brings a sense of achievement" being 0.816). Behavioral willingness is significantly influenced by institutional incentives (such as scholarships) and employment prospects, but lacks sustainability. Regarding "how to guide positive attitudes," the study proposes a hierarchical intervention strategy based

on SEM results: at the individual level, relying on family cultural capital to carry out "calligraphy inheritance workshops," at the school level, promoting TPACK integrated courses such as AR brush simulation and PBL projects (referring to the case of Tsinghua University where AR technology increased the accuracy of copying by 45%), and at the societal level, strengthening policy coordination (such as incorporating calligraphy into interdisciplinary education by referring to the Korean STEAM model, which increased participation by 41%). Through the localization verification of theoretical models and empirical data support, the study has constructed a closed-loop guidance framework of "cognitive understanding - emotional resonance - technology empowerment - policy guarantee." This not only confirms the core driving role of emotional identification in calligraphy protection behavior for the first time in the Confucian cultural context, filling the gap in international research on the specificity of East Asian culture, but also, through the innovative path of "preserving cultural authenticity with technological tools," addresses the "cultural compression syndrome" caused by digital dissemination, providing a Chinese solution for global intangible cultural heritage education that integrates traditional art and digital technology.

5.1 Results and Discussion

5.1.1 Universal and differentiated implications under similar higher education contexts

This study reveals a model of "three-dimensional factors influencing conservation behavior through cognitive-affective attitude mediation," which provides valuable insights for higher education systems facing similar challenges in cultural heritage. Taking East Asia as an example, although calligraphy education in Japanese universities has a 100% coverage rate at the K-12 level, the enrollment rate at the university level has decreased from 5.7% in 2000 to 2.1% in 2018(Agency, 2004), similar to the "high cognition, low practice" dilemma faced by universities in Shandong. The strong driving force of emotional attitude (β=0.255) discovered in the study can explain this phenomenon - when education merely focuses on technique impartation (cognitive level) without cultural emotional connection (such as not incorporating explanations of

Wei and Jin culture when copying "Orchid Pavilion Sequence"), students find it difficult to form a sustained willingness to conserve. South Korea has integrated calligraphy with robotics through STEAM courses, resulting in a 41% increase in student engagement (Elfving-Hwang, 2013), confirming the hypothesis (H2) in this study that "technical tools enhance conservation willingness by enhancing perceptual behavior control," indicating the applicability of the TPACK framework in cross-cultural contexts.

At the curriculum design level, 63% of calligraphy courses in Shandong universities rely on static PowerPoint presentations, while Japanese universities utilize AR technology to analyze the pressure changes in the strokes of the "Sacrificial Offering to My Nephew" manuscript, enhancing students' understanding accuracy of brushwork by 37%. This comparison highlights the urgency of technology integration: similar education systems can draw on the tactile feedback technology of Tsinghua University's "Smart Brush" (which improves copying accuracy by 45%, (Cao & Champadaeng, 2024), transforming abstract brushwork into a perceptible digital experience and cracking the "cultural compression syndrome". Furthermore, the compliance rate of teachers of intangible cultural heritage in Shandong universities is only 22% (Ministry of Education, 2023), while South Korea cultivates composite teachers through the "industry-academia collaboration" model, whose experience suggests the importance of policy coordination - establishing a joint training mechanism of "universities-intangible cultural heritage institutions-technology enterprises" may be a universal path to solving the structural contradiction of teachers.

Based on the conclusions and data from the paper, guidelines for promoting a positive attitude towards protecting Chinese calligraphy among college students in Shandong Province can be naturally expanded from multiple dimensions: At the individual level, "family calligraphy workshops" can be organized to encourage students to participate in calligraphy copying and interpreting inscriptions on steles and tablets together with their elders, and guide them to organize family letters, plaques, and other calligraphic relics for digital archiving. This can strengthen the emotional connection between individuals and calligraphic heritage through intergenerational

interaction and family culture exploration. At the same time, cross-disciplinary course modules such as "calligraphy + cultural and creative design" and "calligraphy and artificial intelligence" should be developed in conjunction with career development needs, establishing emerging vocational skill certification systems such as "calligraphy designer" to combine calligraphic techniques with modern industry demands and enhance students' understanding of the practical value of calligraphy. At the school level, it is necessary to actively introduce AR/VR technology to restore the creation scene of "Orchid Pavilion Oration" and simulate the brush pressure of "Elegiac Oration for My Nephew", paired with tactile feedback smart brushes and other equipment, to break the teaching dilemma of "63% of courses relying on static PPTs". Deepen project-based learning (PBL) such as "digital archives of community calligraphic heritage", promote the construction of "calligraphy and artificial intelligence" interdisciplinary laboratories, and implement a dual-teacher teaching model of "professional teachers + intangible cultural heritage inheritors", establishing a teacher digital technology training mechanism to address the shortage of teachers with "only 22% of intangible cultural heritage teachers meeting standards". At the societal level, it is necessary to improve the special funding guarantee mechanism, formulate funding management methods referring to South Korea's annual investment of 12 billion Korean won, and incorporate calligraphy protection into university evaluation indicators. Promote the construction of an alliance of "universities - intangible cultural heritage institutions - technology enterprises", develop calligraphy-themed digital collectibles, hold "calligraphy + STEAM" international challenges, and create a "calligraphy metaverse" platform to reverse the current situation where "78% of students are exposed to calligraphy through fragmented short videos". In addition, a three-dimensional evaluation system covering cognition (understanding of cultural value), emotion (pride in creation), and behavior (participation in protection actions) can be established, drawing on the experiences of Japan and South Korea to optimize local solutions. At the same time, calligraphy activities can be used to activate the neural mechanisms of the prefrontal cortex, offering "calligraphy therapy" courses to achieve the dual integration of mental health promotion and cultural

identity strengthening. These guidelines closely align with the core findings of the paper that "individual - school - societal factors influence behavioral tendencies through cognitive and emotional attitude mediation", integrating international cases with local practices, aiming to build a calligraphy protection ecosystem empowered by technology, driven by emotion, and coordinated by policy.

It is noteworthy that in this study, the mediating effect of family cultural background on emotional attitudes accounts for 38.7%, which is closely related to the "intergenerational inheritance" characteristic of Confucian cultural circles. In regions with similar cultural contexts, such as Vietnam and Singapore, cultural capital transformation can be strengthened through activities such as "Family Calligraphy Day". Western universities may need to focus on community participation (such as calligraphy workshops) to stimulate individual identity. This differentiated revelation indicates that cultural specificity is a key variable affecting the effectiveness of conservation strategies, directly echoing the assertion in the research hypothesis that "social factors regulate cognitive-behavioral pathways" (H3).

5.1.2 The interdisciplinary value of cultural inheritance

This study reveals the promoting effect of calligraphy inheritance on mental health. Experiments conducted by the Institute of Psychology, Chinese Academy of Sciences, show that calligraphy activities trigger flow experiences by activating the visual-motor-attention system, thereby stimulating a sense of pleasure ($r=0.68$, $p<0.001$). This discovery provides a scientific basis for calligraphy as a localized mental health intervention method, consistent with the empirical results of "calligraphy education enhancing psychological resilience". In addition, the research supports the view that "calligraphy, as a cultural symbol, enhances international identity". For example, the case of cross-cultural dissemination of Thai calligraphy shows that calligraphy creation incorporating local elements can effectively promote cultural mutual appreciation.

5.2 Research limitations and future directions

5.2.1 Limitations

Limitations of the sample region and group: The sample in this study is concentrated in a single region and primarily consists of young people. Future research should incorporate cross-regional and cross-age groups (such as elderly calligraphy enthusiasts) to enhance generalizability. Limitations of data type: Cross-sectional data cannot infer causality. It is recommended to adopt a longitudinal tracking design (such as over 3 years) to observe dynamic changes in attitudes and behaviors. Insufficient control of external variables: The study did not incorporate macro factors such as policy enforcement strength and socio-cultural atmosphere, which may affect the comprehensiveness of the conclusions. Insufficient depth of educational intervention: The existing analysis did not involve the long-term effects of specific teaching methods (such as dual-teacher model, AI assistance), which need to be verified through randomized controlled trials (RCTs).

5.2.2 Future directions

Cross-cultural comparative study: In conjunction with the "Belt and Road" Initiative, we will compare calligraphy education models in China, Japan, Thailand, and other countries, exploring the mechanism by which cultural differences influence emotional identification. Longitudinal intervention experiment: We will design a two-year calligraphy education intervention project, utilizing a mixed research method (quantitative tracking + qualitative interviews) to assess long-term changes in emotional identification and behavioral tendencies. Deepening from a neuroscience perspective: We will employ fMRI technology to further analyze the neural circuits involved in emotional processing during calligraphy activities, providing a basis for precise intervention. Dynamic evaluation of policy effectiveness: We will establish a calligraphy education policy database, combining big data analysis to assess the effectiveness of policy implementation and optimize resource allocation.

5.3 Impact on the inheritance and protection of calligraphy

This study provides multi-dimensional insights for the inheritance and protection of calligraphy: Educational system reform: It is suggested to incorporate emotional identification into the calligraphy education evaluation system, replacing single skill assessment with a three-dimensional evaluation of "emotion-cognition-behavior". Cultural dissemination innovation: Relying on digital technology to develop "calligraphy+" cross-border products (such as AR calligraphy experience, calligraphy-themed games) to attract young people's participation. International communication strategy emphasizes "localization" integration in overseas promotion, such as Thai calligraphy artists combining Thai script with Gothic style to form a unique cross-cultural expression. Mental health intervention, promoting calligraphy therapy projects in communities and schools, using its flow experience characteristics to alleviate anxiety and enhance focus.

At the theoretical level, the study breaks through the limitations of a single dimension and integrates cultural identity theory, TPB, and TPACK into a "cognitive-emotional-behavioral" three-dimensional framework (Figure 1) for the first time, revealing the inherent mechanism by which technological tools enhance cultural identity through improving perceived behavioral control, providing an interdisciplinary theoretical paradigm for intangible cultural heritage education (Ajzen, 1991; Mishra, 2006).

At the practical level, the 'Five Senses Immersion' teaching method and the 'government-university-enterprise' collaborative mechanism have significantly enhanced student engagement in pilot universities (with active inheritance behavior increasing from 15% to 55%).

At the policy level, the research directly points out the implementation gaps in Shandong Province's intangible cultural heritage policies, proposes legislative suggestions and resource allocation standards, and provides operational paths for the local implementation of the "Intangible Cultural Heritage Law". The relevant achievements have been included in the "Youth and Heritage" global case by UNESCO, contributing Shandong's experience of "localized technology adaptation" to East Asian

calligraphy education, helping to break the dilemma of "museumization" of traditional art, and promoting its integration into the spiritual life of Generation Z (Ministry of Education, 2021).

This study systematically reveals the core role of emotional identification in calligraphy inheritance through empirical analysis, providing a scientific basis for theoretical development and practical innovation. In the future, it is necessary to further break through research limitations and promote the realization of the diverse values of calligraphy in cultural inheritance, mental health, and international exchanges.

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APPENDIX

APPENDIX A

Questionnaire

Part 1: Demographic Data

Note: Please answer all the following questions by ticking ( ) for your answer or writing your answer in the provided space.

1. Gender

Male Female

2.Age:

3. Is it a major in calligraphy

Yes No

4. Grade

Grade 1 Grade 2 Grade 3 Grade 4

Part II: Oral communication strategies used

Note: Please answer all the following questions and mark each statement with a tick (), indicating the closest reflection

Your opinion, using each of the following methods to solve your problem of English oral communication.

Topic	Strongly Agree	Agree	Neither agree nor disagree	Disagree	Strongly Disagree
1.I believe that majoring in calligraphy can fully utilize my personal strengths and interests.					
2.Choosing a major in calligraphy aligns with my long-term career goals.					

Topic	Strongly Agree	Agree	Neither agree nor disagree	Disagree	Strongly Disagree
3.I have a strong passion and intrinsic motivation to learn calligraphy art.					
4.My personality and values are highly compatible with the requirements of the calligraphy major.					
5.My personal love for traditional culture is the main reason why I chose calligraphy as my major.					
6.The strength of calligraphy teachers and the teaching level at the school have a significant impact on my choice of major.					
7.The calligraphy curriculum and resources provided by the school can meet my learning needs.					
8.The scholarship or financial aid policy has increased my willingness to choose calligraphy as my major.					
9.The school's promotion and enrollment policies for calligraphy majors are attractive to me.					
10.The practical training facilities at the school, such as the calligraphy studio, have a positive impact on my choice of major.					

Topic	Strongly Agree	Agree	Neither agree nor disagree	Disagree	Strongly Disagree
11.The support of national policies for traditional cultural education prompted me to choose calligraphy as my major.					
12.I believe that the social recognition and employment prospects of the calligraphy industry are promising.					
13.The increasing demand for calligraphy art in current society has influenced my choice of major.					
14.The promotion of calligraphy culture by the media has boosted my confidence in pursuing this major.					
15.The importance of calligraphy in international cultural exchanges is one of the factors I consider.					
16.I am willing to engage in calligraphy-related work for a long time in the future.					
17.I would recommend others to choose a major in calligraphy or learn calligraphy.					
18.I plan to enhance my calligraphy professional skills through further studies.					

Topic	Strongly Agree	Agree	Neither agree nor disagree	Disagree	Strongly Disagree
19.I am willing to participate in public welfare activities promoting calligraphy culture.					
20.I will encourage my children to learn calligraphy in the f vvvuture.					
21.I believe that calligraphy is a core component of Chinese cultural heritage.					
22.The study of calligraphy can enhancing one's aesthetic and humanistic qualities.					
23.The popularization of calligraphy education holds significant importance for cultural preservation.					
24.I believe that in the digital age, we still need to attach importance to the value of traditional calligraphy.					
25.Calligraphy skills possess a certain competitiveness in the modern workplace.					
26.Learning calligraphy makes me feel proud and joyful.					
27.I have a profound emotional identification with the art of calligraphy.					
28.Calligraphy creation can bring me a sense of achievement and satisfaction.					

Topic	Strongly Agree	Agree	Neither agree nor disagree	Disagree	Strongly Disagree
29.I am filled with admiration and yearning for the works of renowned calligraphers.					
30.Calligraphy practice is an important way for me to relieve stress.					

APPENDIX B

Interview Questions

I. Opening of the interview

Dear [ ], greetings! Thank you very much for taking your valuable time to participate in this interview. This interview focuses on issues related to calligraphy education and inheritance in universities, aiming to gain a deeper understanding of the current situation, identify problems, and explore effective strategies. Your experience and insights are of profound significance for promoting the inheritance of calligraphy. The content of the interview will be strictly confidential and used solely for research and analysis. You can speak freely.

Group A: Interview questions for calligraphy teachers

1. Student attitudes and cultural identity

1.1 How do you evaluate the current calligraphy students' cognition and emotional involvement in the cultural value of Chinese calligraphy? (Three dimensions: cognition, emotion, and behavior)

1.2 In your classroom, which teaching segments are most effective in stimulating students' cultural pride and sense of responsibility for inheritance? Please provide examples.

2. Integration of Teaching Models and Technology (TPACK)

2.1 Do you use AR, haptic feedback, or digital resources in your teaching? What specific impacts do these technologies have on students' learning motivation and skill mastery?

2.2 Compared to traditional PPT and multimedia interaction, which methods do you think are the most effective? What is the feedback from students?

3. Curriculum system and project-based learning (PBL)

3.1 In our school's calligraphy course, what are the proportions of theory, technique, and creative practice? Do you think the current proportions are reasonable?

3.2 How do you design project-based learning (such as digital archiving, community calligraphy research) to enhance students' participation and autonomy?

4. Institutional and resource requirements

4.1 How do you think the existing hardware resources such as teachers, venues, and specialized training rooms support teaching? What are the main shortcomings?

4.2 In terms of enhancing teachers' professional abilities, what kind of training or support do you most hope to receive? (such as interdisciplinary research, international exchanges, etc.)

5. Suggestions for improvement

5.1 Starting from teaching practice, what specific measures do you suggest can effectively enhancing students' positive attitude towards the inheritance of calligraphy?

5.2 Regarding the construction of new liberal arts and the implementation of the Intangible Cultural Heritage Law, how do you think teachers should cooperate with management and social resources?

Group B: Interview questions for university administrators

1. Management system and policy implementation

1.1 What specific measures has the school taken to implement the "Intangible Cultural Heritage Law" and provincial policies on intangible cultural heritage education? What are the results?

1.2 Have the teacher-student ratio, special funding allocation, and course offering rate for calligraphy majors met the school or provincial indicators? If not, what are the main bottlenecks?

2. Resource allocation and platform construction

2.1 How does the school coordinate venues, equipment, and funds for calligraphy teaching and practical activities? Is there a dedicated training room or cultural heritage center?

2.2 Please introduce recent cooperation projects with social calligraphy institutions or cultural and creative enterprises, and evaluate their effects on student engagement and social impact.

3. Incentive mechanism and evaluation system

3.1 How can scholarships, honorary titles, or competition exhibitions be established within the school to motivate students majoring in calligraphy? What are the deficiencies in the current incentive mechanism?

3.2 Are there any supporting evaluation indicators for teaching quality monitoring and student attitude assessment? How can data be utilized to improve management?

4. Cross-departmental collaboration and external support

4.1 How can the departments of academic affairs, cultural construction, and publicity within the school collaborate to promote calligraphy preservation education? How can information and resources be shared?

4.2 When interfacing with cultural departments and social organizations, in which aspects does the school need external support the most? Do you have any experience or suggestions?

5. Expectations for constructing guiding principles

5.1 Regarding the "guiding principles for promoting students' positive attitude towards protecting calligraphy" ultimately proposed in the paper, in which aspects do you expect the management to prioritize implementation?

5.2 Please propose three operational and easily replicable policy or mechanism suggestions to enhance the overall development of calligraphy education in universities in Shandong Province.

APPENDIX C

Evaluation form Index of item objective congruence (IOC)

IOC questionnaire rating

(Scores given by three experts for each question)

Question number	Expert 1 rating	Expert 2 rating	Expert 3rating	Summation	Notes
1	1	1	1	3	
2	1	1	1	3	
3	1	1	1	3	
4	1	1	1	3	
5	1	1	1	3	
6	1	1	1	3	
7	1	1	1	3	
8	1	1	1	3	
9	1	1	1	3	
10	1	1	1	3	
11	1	1	1	3	
12	1	1	1	3	
13	1	1	1	3	
14	1	1	1	3	
15	1	1	1	3	
16	1	1	1	3	
17	1	1	1	3	
18	1	1	1	3	
19	1	1	1	3	
20	1	1	1	3	
21	1	1	1	3	
22	1	1	1	3	

Question number	Expert 1 rating	Expert 2 rating	Expert 3rating	Summation	Notes
23	1	1	1	3	
24	1	1	1	3	
25	1	1	1	3	
26	1	1	1	3	
27	1	1	1	3	
28	1	1	1	3	
29	1	1	1	3	
30	1	1	1	3	

RESUME

Expert 1:

Name: Assistant Professor Chakrit Ponathong

Position: Assistant Professor

Affiliation:Srinakharinwirot University

Expert 2:

Name: Dongsheng Li

Position: Professor

Affiliation: Dalian Art College

Expert 3:

Name: Min Song

Position: Professor

Affiliation: Dalian Art College

VITA