

Gaining Insights and Understanding Principles through the Study of Excellent Traditional Chinese Mathematical Culture: Reflections on Zhang Weizhong's *The Remarkable Traditional Chinese Mathematical Culture*

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ABSTRACT

The Remarkable Traditional Chinese Mathematical Culture, edited by Professor Zhang Weizhong from Zhejiang Normal University, was published by East China University of Science and Technology Press in September 2024. Through 18 thematic chapters—covering magic squares, the mathematics of tonality, Chinese paper-cutting, water clocks, Zhao Shuang's chord diagram, and more—the book draws on detailed research and a richly illustrated writing style to present each topic accessibly yet with scholarly rigor. The exploration unfolds across four dimensions: tracing historical origins, examining mathematics and culture, validating knowledge through practice, and exploring applications and extensions. Employing diverse research methods, the work delves deeply into treasures of traditional mathematical culture, promotes the integration of this heritage with mathematics education, and supports the ongoing development of the new curriculum reform, thereby effectively strengthening cultural confidence among teachers and students. Furthermore, the book provides a paradigm for subsequent academic research, significantly enriches readers' knowledge base, and offers valuable insights and guidance for teaching practices.

KEYWORDS

Excellent traditional Chinese culture; Mathematical culture

1 Introduction

In September 2024, East China University of Science and Technology Press published *The Remarkable Traditional Chinese Mathematical Culture*, edited by Zhang Weizhong—a professor and doctoral supervisor at the College of Education, Zhejiang Normal University, as well as a mathematics discipline expert in the Ministry of Education's "National Training Program"—with Tang Hengjun and Ni Ming serving as associate editors^[1]. The book explores 18 thematic areas, including magic squares, mathematical principles in tonality, Chinese paper-cutting, water clocks, Zhao Shuang's chord diagram, Mei Wending's work on the Pythagorean theorem, the method of solving equations, tangrams, arch bridges, mathematics in the use of compasses and carpenter's squares, the cyclotomy method, Tian Ji's horse racing, norias, the gnomon, Yang Hui's triangle, geometry in ancient vessels, the principle of complementarity, and shadow puppetry. Drawing on detailed research materials and adopting a richly illustrated writing style, the book offers thorough, vivid, and accessible explanations of each theme through four dimensions: tracing historical origins, exploring mathematics and culture, validating knowledge through practice, and extending knowledge through practical applications.

Based on a careful study of the Mathematics Curriculum Standards for Compulsory Education (2022 Edition) and various textbook editions, the book comprehensively covers the cultural elements highlighted in the curriculum standards. Through the collection, organization, and analysis of mathematics examination questions related to mathematical culture from the past decade's secondary school entrance exams, the editors have systematically compiled exemplary test points for each thematic area. Whether used by teachers to enhance instruction or by students to broaden their horizons and improve their competencies, readers can benefit greatly from the book's clear and systematic exposition. This work successfully bridges the gap between abstract curriculum standards and concrete examination practices while embedding cultural meaning, thereby strongly promoting the integration of mathematical culture into the stage of compulsory education.

2 The remarkable traditional chinese mathematical culture provides a paradigm for research on integrating excellent traditional mathematical culture into teaching

Based on a meticulous study of the Compulsory Education Mathematics Curriculum Standards (2022 Edition), extensive collection of chapters involving traditional excellent culture from various editions of junior high school mathematics textbooks, and mathematics test questions containing mathematical cultural content from the past decade's secondary school entrance examinations, and synthesizing detailed literature from numerous scholars domestically and internationally, Professor Zhang Weizhong has compiled the nearly 190,000-word book *The Remarkable Traditional Chinese Mathematical Culture*, which draws on diverse strengths while establishing its own unique character.

This book provides a model for teachers and mathematics education researchers in defining the research scope, adopting methods, and selecting content pertaining to WHAT mathematical culture to integrate and HOW to integrate it.

2.1 The significant meaning of research in the remarkable traditional Chinese mathematical culture

2.1.1 In-depth excavation and systematic inheritance of traditional mathematical cultural treasures

In the context of today's globalized era, many excellent Chinese traditional mathematical cultures risk being neglected or diluted. One purpose of the research in this book is to delve into the long river of history to salvage those shining treasures of traditional mathematical culture. From ancient mathematical classics like *Nine Chapters on the Mathematical Art* and *Zhoubi Suanjing*, it carefully explores the ancient people's exquisite insights, unique algorithms, and distinctive mathematical thinking modes in the field of mathematics. Drawing upon enduring symbols of ancient ingenuity—such as tonality, paper-cutting, water clocks, arch bridges, and gnomons—this work extracts their underlying mathematical principles, unveils a unique aesthetic of life, and contemplates the profound philosophy embedded within. By systematically organizing these contents, it integrates the essence of traditional mathematical culture scattered in various places, presenting it in a clear and structured form, thereby achieving effective inheritance of Chinese traditional mathematical culture.

2.1.2 Promoting the organic integration of traditional mathematical culture and modern mathematics education

Modern mathematics education should not be confined solely to teaching abstract theories and formulas; it needs to incorporate rich cultural connotations, making it vivid and profound. Through careful study of curriculum standards, textbooks, and secondary school entrance examination papers, this book identifies the points of convergence between traditional mathematical culture and modern mathematics education, achieving an organic combination of the two. On one hand, it skillfully integrates classic cases, stories, and mathematical ideas from traditional mathematical culture into daily mathematics classroom teaching, bringing those cold numbers and symbols to life. On the other hand, it explores innovative teaching models based on traditional mathematical culture, breaking the rigid framework of traditional teaching, guiding students to explore mathematical problems from a cultural perspective, and cultivating their innovative thinking and comprehensive literacy, thereby breathing new life into modern mathematics education and endowing it with distinctive features.

2.1.3 Assisting mathematics curriculum reform to reach a new level

As educational concepts evolve and mathematics curriculum reform advances, documents such as the *Compulsory Education Mathematics Curriculum Standards (2022 Edition)* have raised expectations for integrating culture into subject teaching. This book positions itself at the forefront of curriculum reform, establishing a theoretical and practical framework to support its development. Through in-depth research on traditional Chinese mathematical culture, it identifies content suitable for junior high school students at different learning stages. On one hand, it offers teachers rich and practical teaching resources and guidance. Educators can integrate the well-organized cultural content from the book into daily lessons, creating teaching scenarios that are culturally meaningful and cognitively appropriate. This also helps teachers update their instructional concepts—shifting from solely knowledge transmission to emphasizing the cultivation of both cultural literacy and mathematical ability. It guides students to explore mathematics from a cultural perspective, deepening their thinking and better achieving the curriculum's goals for comprehensive literacy.

On the other hand, the book provides textbook compilers with diverse strategies for organically incorporating traditional mathematical culture. This ensures these cultural elements are both pedagogically effective and culturally resonant, ultimately helping mathematics curriculum reform take root in China's cultural soil and nurturing a new generation with solid mathematical competence and profound cultural awareness.

2.1.4 Enhancing cultural confidence among teachers, students, and the whole society

Amid growing global exchanges, Western cultural influence has led to insufficient recognition of China's own traditional mathematical culture, resulting in a lack of cultural confidence. This book highlights the profound value of Chinese mathematical heritage, enabling students to take pride in achievements such as Zu Chongzhi's pioneering calculation of π . It inspires appreciation for Chinese culture and strengthens cultural identity. For educators, it provides resources to convey the uniqueness of this heritage in the classroom, sowing seeds of cultural confidence. On a broader social level, the book fosters public awareness and pride in traditional mathematical culture, enhancing national cultural confidence.

2.2 Research methods in the remarkable traditional Chinese mathematical culture

This book employs multiple research methods, such as: literature research method, historical research method, case analysis method, comparative research method, and interdisciplinary research method.

(1) Literature Research Method. The editors collected and analyzed extensive domestic and international materials on traditional Chinese mathematical culture. They systematically synthesized content across themes, developing logically rigorous chapters. For instance, in "Marvelous Number Combinations: Magic Squares," the method was used to comprehensively organize the origin, algebraic and geometric relationships, Yang Hui's summation technique, solution methods, and ancient-modern applications of magic squares.

(2) Historical Research Method. Using relevant historical materials, the book studied the developmental context of traditional mathematical culture according to the sequence of historical development, providing readers with a holistic perspective on the development of Chinese excellent traditional mathematical culture. For instance, in the chapter "The Mystery of Ancient Timekeeping: Water Clocks", the book details the development of water clocks as a timekeeping tool in ancient China.

(3) Case Analysis Method. The book selects representative cases of Chinese traditional mathematical culture, using specific mathematical problems, phenomena, or practical activities as entry points to explore the application and value of Chinese traditional mathematical culture in solving practical problems. For example, in chapters on water clocks, arch bridges, gnomons, and norias, it deeply analyzes the mathematical knowledge, principles, and methods contained within.

(4) Comparative Research Method. It contrasts Chinese traditional mathematical culture with the mathematical cultures of other countries or regions, analyzing their similarities and differences, thereby better understanding the uniqueness and value of Chinese traditional mathematical culture. For example, in the chapter "The Peerless Skill in Ancient Chinese Geometry: The Cyclotomy Method," the book introduces not only the outstanding contributions of Chinese mathematicians Liu Hui and Zu Chongzhi but also the method of exhaustion used by Archimedes in calculating π .

(5) Interdisciplinary Research Method. This approach integrates mathematics with fields such as history, cultural studies, philosophy, and art. It examines the formation and development of traditional mathematical culture through cultural perspectives, explores its unique thinking modes through philosophical analysis, and investigates its interdisciplinary connections—such as the relationship between mathematics and music, and mathematics and art.

2.3 The selection of research content in the remarkable traditional Chinese mathematical culture

Indeed, Chinese excellent traditional mathematical culture is vast, profound, and has a long history. Attempting to include all content in the book would only to lose the main subject and focus. Based on the Compulsory Education Mathematics Curriculum Standards (2022 Edition) and various textbook editions, this book deeply explores the writing themes and the main points of each theme, ultimately refining more than 20 themes down to 18, with further expansion and adjustment of the content. This selection of research content is focused, highlighting key points without losing the main subject, providing a research model for teachers and mathematics education researchers regarding the selection of teaching content and research on related mathematical culture.

3 Multidimensional insights from the remarkable traditional Chinese mathematical culture

3.1 Academic research: multidimensional academic guidance

In terms of research significance, the book highlights how traditional Chinese mathematical culture embodies the wisdom and innovative spirit of ancient scholars. By exploring these cultural treasures, it fosters the integration of traditional mathematics into modern education, supports curriculum reform, and strengthens cultural confidence among teachers and students. Regarding research methods, the book employs a multi-faceted approach, combining literature review and historical analysis to systematically organize scattered mathematical cultural materials. It integrates these elements through logical reasoning, offering readers a holistic and multi-dimensional perspective. This methodology provides a valuable reference for future scholars. In content selection, the book uses the Compulsory Education Mathematics Curriculum Standards (2022 Edition) and mainstream textbooks as frameworks. This targeted approach ensures focus on core issues and enhances the relevance of the research. It serves as an exemplary model for effectively navigating vast and complex cultural resources, thereby improving the scientific rigor of mathematical culture studies.

3.2 Knowledge accumulation: enriching knowledge and deepening understanding

"The Remarkable Traditional Chinese Mathematical Culture" enriches readers' knowledge through 18 thematic studies spanning mathematical history and interdisciplinary fields. It covers key areas such as algebra, geometry, and statistics,

while also revealing connections with philosophy, astronomy, and aesthetics. The book highlights unique Chinese mathematical thinking—such as holistic reasoning and procedural algorithms—offering a valuable contrast to Western analytical approaches. This helps readers appreciate diverse thinking modes and solve problems from multiple perspectives. Furthermore, it deepens understanding of mathematical culture, inspires appreciation for ancient scholars' rigor, and stimulates innovative thinking, thereby supporting further academic exploration.

3.3 Teaching practice: empowering the classroom and promoting growth

"The Remarkable Traditional Chinese Mathematical Culture" provides rich materials for integrating traditional mathematical elements into classrooms. Its 18 themes cover key areas of junior high mathematics, helping teachers introduce cultural content at appropriate stages to enhance teaching effectiveness. By incorporating these elements, abstract mathematical knowledge becomes more vivid and meaningful, enriching the learning experience. Chinese traditional mathematics features unique thinking modes and problem-solving techniques—such as the Out-In Complementary Principle, equation-solving methods, and cyclotomy—which differ from Western approaches. Integrating these into teaching encourages students to think beyond conventional frameworks and develop multi-dimensional problem-solving skills. Exploring these methods broadens students' thinking and strengthens core mathematical competencies like logical reasoning and intuitive imagination. Moreover, learning about the brilliant achievements of ancient Chinese mathematics and its underlying humanistic values provides subtle moral education. Students are inspired by stories of mathematicians who pursued truth with rigor and perseverance under difficult conditions, encouraging diligence and excellence in their own studies. Concepts such as "compasses and squares" can be extended to discuss the importance of rules and norms, while the "gnomon" symbolizes integrity and moral clarity. Through such integration, mathematical culture not only enhances knowledge acquisition but also fosters character development.

In summary, *The Remarkable Traditional Chinese Mathematical Culture* is an accessible yet academically rigorous monograph that effectively bridges mathematical culture and education. Written in clear language with solid research, it offers students rich learning resources to broaden their knowledge and stimulate interest in mathematics. For teachers, its diverse themes serve as a valuable repository for creating culturally enriched classrooms. Additionally, it provides mathematics education researchers with rigorous methodologies and fresh perspectives, promoting further exploration of cultural value and advancing mathematics education.

References

- [1] Zhang Weizhong, Tang Hengjun, Ni Ming. *The Remarkable Traditional Chinese Mathematical Culture* [M]. Shanghai: East China University of Science and Technology Press, 2024.
- [2] Chen Yaping, Fu Zhuo. Integrating Excellent Traditional Chinese Culture into Elementary School Mathematics Classroom Teaching in Ethnic Regions: Connotation, Value, and Approaches [J]. *Journal of Research on Education for Ethnic Minorities*, 2019, 30(05): 126-131.
- [3] Zhang Ziwei. *A Century of Changes in the Integration of Excellent Traditional Chinese Culture into Elementary School Mathematics Textbooks* [D]. Kashgar University, 2023.
- [4] Wang Xiaoqin. Several Pathways for Integrating Excellent Traditional Chinese Mathematical Culture into Mathematics Teaching [J]. *Educational Research and Review (Elementary Education and Teaching)*, 2022, (11): 5-10.
- [5] Wang Xiaoqin. Several Pathways for Integrating Excellent Traditional Chinese Mathematical Culture into High School Mathematics Teaching [J]. *Educational Research and Review (Secondary Education and Teaching)*, 2022, (09): 27-34.
- [6] Wang Xiaoqin. Several Pathways for Integrating Excellent Traditional Chinese Mathematical Culture into Junior High School Mathematics Teaching [J]. *Educational Research and Review (Secondary Education and Teaching)*, 2022, (06): 34-39.
- [7] Cao Yiming. Integrating Excellent Traditional Chinese Mathematical Culture into Elementary and Secondary School Mathematics Curricula: From Significance to Implementation [J]. *Educational Research and Review*, 2022, (06): 46-49.
- [8] Yue Zengcheng, Chen Zixin, Lin Yongwei. Integrating Excellent Traditional Chinese Mathematical Culture into the Classroom: Value, Standards, and Pathways—Taking the "Principle of Complementarity" as an Example [J]. *Primary School Teaching (Mathematics Edition)*, 2022, (04): 4-7.