

Review and Prospect of the Inclusion of Chinese Abacus in the Representative List of the Intangible Cultural Heritage of Humanity

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How to cite this paper: Lin, Y.-H. (2022). Review and Prospect of the Inclusion of Chinese Abacus in the Representative List of the Intangible Cultural Heritage of Humanity. *Chinese Studies*, 11, 239-257. <https://doi.org/10.4236/chnstd.2022.114018>

Received: February 19, 2022

Accepted: October 25, 2022

Published: October 28, 2022

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Abstract

This study adopts the field survey method. The purpose of the research is to track the changes of abacus culture and education in the past 12 years, and focuses on the changes in the key three years before and after the inclusion of the Chinese abacus in the Representative List of the Intangible Cultural Heritage of Humanity through the resolution by the “United Nations Educational, Scientific and Cultural Organization” (UNESCO) in 2013. Therefore, this study is divided into two stages of time axis: the first stage is from 2013 to 2016, namely the three years after Zhusuan was listed in the Representative List of the Intangible Cultural Heritage of Humanity, in which the protection and revitalization of Zhusuan were discussed through field investigation, a questionnaire prepared by the researcher, and in-depth interviews. The second stage is from 2016 to 2019, in which the work reports of representatives of various countries in these three years were interviewed through the network to collect data and discuss the inheritance and dissemination of Zhusuan culture. The research results show that, since 2019, the cultural education of “Zhusuan—knowledge and practices of mathematical calculation through the abacus” has expanded from the Chinese cultural circle to non-Chinese cultural circles, and the cross-cultural education of Zhusuan and cultural and educational industry cover five continents around the world. This not only reflects the role played by the “Belt and Road Initiative” in the Representative List of the Intangible Cultural Heritage of Humanity, but it also makes the Chinese abacus part of a truly world-class Representative List of the Intangible Cultural Heritage of Humanity. According to the research results, the researcher puts forward three suggestions: 1) from a protection project to education inheritance; 2) from folk customs to cultural regeneration; 3) from the folk economy to social practice.

Keywords

The Belt and Road Initiative, Representative List of the Intangible Cultural Heritage of Humanity, Chinese Abacus, Cross-Cultural Education, Abacus

1. Introduction

UNESCO held a review meeting on December 4, 2013 (local time) in Baku, the capital of Azerbaijan, which approved “Zhusuan—knowledge and practices of mathematical calculation through the abacus”, and listed the “Chinese abacus” in the Representative List of the Intangible Cultural Heritage of Humanity. UNESCO evaluated Zhusuan, as follows:

The Chinese abacus is a traditional calculation method with a long history, which uses the abacus as the tool to perform mathematical calculations by moving beads with the fingers. Thus, it is both a symbol of the cultural identity of the Chinese people with multiple social and cultural functions and a practical tool providing the world with another knowledge system. The inclusion of the Chinese abacus in the Representative List helps to raise the visibility of intangible cultural heritage and promotes respect for human creativity, especially as an example adapted to contemporary needs (Editorial Department of Chinese Abacus Culture Atlas, 2015).

Protecting the Representative List of the Intangible Cultural Heritage of Humanity is a global action initiated by UNESCO, which has the ultimate goal of ensuring the sustainability of the cultural assets of humanity. The reason Zhusuan is included in the Representative List of the Intangible Cultural Heritage of Humanity represents that it has a certain cultural inheritance crisis, and must be urgently protected. At present, the inheritance of Zhusuan culture mostly depends on the operation and support of abacus-based mental arithmetic (Zhusuan and Zhusuan-based metal arithmetic) teachers and relevant the cultural and educational industries and organizations. This Chinese culture, which has been passed from generation to generation for thousands of years, has been developed and applied in different ways to adapt to the social background of different eras and to meet the contemporary living needs of people (Lin, 2017).

The Chinese abacus is a very important field in the research of the Representative List of the Intangible Cultural Heritage of Humanity. This study conducts a review and prospect of the inclusion of Zhusuan in the Representative List of the Intangible Cultural Heritage of Humanity, thus, it is necessary to review the academic history of Zhusuan for systematic presentation. With the joint efforts of internal motivation and external driving forces, many innovative achievements have emerged in related studies of Zhusuan, which include at least the following three aspects:

1.1. The History and Culture of Zhusuan and Abacus

The term “Zhusuan” first appeared in *Arithmetic Notes* by Yu Hsu (The Eastern

Han Dynasty) in the Eastern Han Dynasty. There are many relevant studies that put Zhusuan in the grand background of Chinese cultural history to expound the culture and history of Zhusuan and its relationship with folk economy, such as *Along the River During the Qingming Festival* by Zeduan Zhang in the Northern Song Dynasty, *Japanese Fudoki* “そおはん” by Chi-Kao Ho (The Ming Dynasty) in the Ming Dynasty, “The History of the Abacus” by Pullan (1968) in the UK, “The History of the Abacus” translated by 塩浦政男 (1974) in Japan, *Treasures of Ancient and Modern Arithmetic* by Wen-Su Wang in the Ming Dynasty, “Science and Civilization in China” by Joseph Needham (1971) in the UK, *History of Chinese Arithmetic* by Yan Li (1984), *Historical Manuscript of Chinese Abacus* by Yin-Chun Hua (1987), *Chinese Abacus* by Nin-Wan Yu (1990), *Chinese Mental Arithmetic* by Ssu-Chung Hsu (1992), *Contemporary Chinese Abacus* by Xi-An Chu and Tseng-Yi Yeh (2000), *New Computing Techniques: Zhusuan and Abacus-based Mental Arithmetic* by Chia-Shen Wang et al. (2003), *Evergreen Zhusuan* by De-He Chang (2011), “A Study on the Zhusuan Culture in Ancient China and East Asia” by Ling Chen (2013), “Cultural Assets and Intangible Cultural Heritage—Taking the Development History of Chinese Abacus as the Research Object” by Yu-Hui Lin (2017), *Technology Culture in Ancient China* by Hsiao-Yuan Chiang (2017), “Scientific Discovery in Ancient China 12: Chinese Abacus” by Li-Shen Feng (2018), *Intangible Cultural Heritage: From Inheritance to Dissemination* by Hung Yang (2019), etc. Based on historical data collection, these achievements restore some important aspects of Zhusuan, endow Zhusuan with proper historical status, and broaden the research scope of the Representative List of the Intangible Cultural Heritage of Humanity.

1.2. Education Functions of Zhusuan and Mental Arithmetic

The research related to Zhusuan and educational science has attracted wide-spread attention in academic circles, including “Discussion on the Enlightening Functions of the Education of Zhusuan from the Essence of Zhusuan Learning” by Hsi-Chin Li (1994), “A Study on Professional Competence of Abacus and Mental Arithmetic Teachers” by Hueh-Chen Lin (2009), “Investigation on ‘Abacus’ and ‘Zhusuan’” by Yu-Hui Lin (2011), “The Development and Modern Significance of Mechanized Mathematics in the Ming Dynasty” by Chin-En Liu (2015), “Constructing the Brain Fitness Course of Abacus-based Mental Arithmetic for the Elderly: Expanding the Social and Cultural Functions of Zhusuan” by Ping Lu and Ling Chang (2017), etc. The research related to special education includes “A Survey on Teaching Abacus to Blind Students by Elementary School Teachers of Students with Visual Impairments” by Shihuh-pei Yeh (2010), “Abacus Teaching Multiplication and Division Calculations on the Effectiveness of Visually Impaired Students in Case Study” by Deng-Kai Chan (2010), “A Case Study on the Improvement of Mathematical Computing Ability of Primary School Students with Low Vision by Zhusuan Learning” by Po-Yu Wang (2015), “A Brief Discussion on the Integration of Zhusuan Teaching into Mathematics

in Primary Schools for the Blind” by Yueh Fu and Chieh Fu (2019), “Application of Micro-Lesson in Zhusuan Teaching in Primary Schools for the Blind” by Yen-Ping Lai and Hui-Ting Tseng (2019), etc. In particular, it also includes the patented invention by Tao Fu, Hsueh-Feng Tuan, and Wei Pan (2017), the “Table Structure of Board Games Based on the Cultivation of Children’s Zhusuan Ability”. The studies of the abovementioned scholars regarding the educational theories of Zhusuan, teachers’ professional functions, micro-lesson information technology, board game patent, and special education demonstrate the positive correlation between the integration of Zhusuan and special education.

1.3. The Development of Zhusuan Education and Application of Other Disciplines

The main research achievements of integrating Zhusuan education into the application of other disciplines, or applying other disciplines into Zhusuan education, include “Internet + Abacus-based Mental Arithmetic Teaching and Training System” by Chun-Chieh Li and Fan Chang (2018), “A Brief Discussion on the Effective Integration of Information Technology and Abacus-based Mental Arithmetic Teaching” by Liang Li (2019), etc. Research shows that information technology education can effectively break through learning difficulties and improve learning interest. The interdisciplinary research of Zhusuan includes: “Mental Abacus Calculation Training Improves Cognitive Function in Elderly People” by Chaur-Jong Hu et al. (2017), “Groups and Emotional Arousal Mediate Neural Synchrony and Perceived Ritual Efficacy” by Philip et al. (2018), “Overview of Research on Abacus-based Mental Arithmetic” by Fei-Yen Chen (2018), “Zhusuan and Abacus-based Mental Arithmetic as Tools for Brain Cognitive Function Training” by Hsin-Lin Chou (2018), etc. The results of clinical scientific experiments, as conducted by interdisciplinary research teams at home and abroad, demonstrate that the training of abacus-based mental arithmetic is beneficial to the operation of the human brain mechanism, and highlight the value of interdisciplinary research.

The research concepts of the above achievements are as follows: to place Zhusuan and the abacus in historical thinking to present the uniqueness of Chinese culture; incorporate Zhusuan education into modern and contemporary society and explore the scientific functions of Zhusuan education from the perspectives of enlightening schoolchildren and invigorating the brain of the elderly; construct the production of Zhusuan education from information technology; reveal the interactions between Zhusuan and educational and medical science from the perspective of special education, preventive medicine, etc.

The modern and contemporary Zhusuan has gradually transformed into the cultural and educational industry, which requires more organized management and effective marketing strategies for the cultural industry to actively regenerate. However, whether a cultural asset in urgent need of protection and the title of “Representative List” approved by UNESCO can enhance its visibility, what changes

will be brought under its protection after its inclusion in the Representative List of the Intangible Cultural Heritage of Humanity, and what inheritance mechanism should be established to achieve the effective practice issues of “education, publicity, and ability training”, as UNESCO calls it, are the topics discussed in this paper.

2. Research Methods and Data Collection

This study adopted the field investigation method, which is a rare research method in the academic history of Zhusuan. Through 12 years of field investigation, in order to better focus on the changes in the key three years before and after the inclusion of Zhusuan in the Representative List of the Intangible Cultural Heritage of Humanity, this study is divided into two stages of time axis: the first stage is from 2013 to 2016, namely the three years after Zhusuan was listed in the Representative List of the Intangible Cultural Heritage of Humanity, in which the protection and revitalization of Zhusuan were discussed through field investigation, a questionnaire prepared by the researcher, and in-depth interviews. The second stage is from 2016 to 2019, in which the work reports of the representatives of various countries in these three years were interviewed through the network to collect data and discuss the inheritance and dissemination of Zhusuan culture.

2.1. The First Stage: From 2013 to 2016

The survey report of the first stage was based on the questionnaire prepared by the researcher, which was implemented on July 28, 2016 at the Crowne Plaza Hong Kong Kowloon East, and the respondents were representatives of Chinese Taipei, Hong Kong (China), Chinese Mainland, Malaysia, the United States, etc. The “Zhusuan Research Questionnaire” (Table 1) is an open questionnaire prepared by the researcher, and was designed with reference to articles 13-15 of the UNESCO *Paris Convention* in 2013 regarding “other protective measures”, “education, publicity, and ability training”, as well as “participation of groups, teams, and individuals”, which are the key items for UNESCO to determine whether an applicant country is fulfilling its commitment to protect the intangible cultural heritage of humanity.

In order to further explore the development of Zhusuan after its inclusion in the Representative List of the Intangible Cultural Heritage of Humanity and to gain comprehensive understanding, the researcher visited Hong Kong for field investigation on July 28, 2016. On that day, the “World Association of Abacus and Mental Arithmetic” (WAAMA) held the “6th World Abacus-based Mental Arithmetic Competition of the World Association of Abacus and Mental Arithmetic” at the Crowne Plaza Hong Kong Kowloon East. The researcher participated in the whole competition and attended the “WAAMA” council meeting as a non-voting member. The Association has 4 “council members” (“WAAMA” does not call them a council member state, to avoid embarrassment among non-

diplomatic countries). The researcher personally delivered the “Zhusuan Research Questionnaire” to the representatives of the participating countries, and conducted in-depth interviews with three directors on the first day. One of the key figures was Dr. Qin-Ying Liu, who was in charge of writing the documents submitted to UNESCO.

2.2. The Second Stage: From 2016 to 2019

In the second stage of the survey, the researcher interviewed the representatives of different countries through the Internet, as based on their work reports in the past three years, and used Google to search for Chinese keywords related to Zhusuan (Table 2) and English keywords related to Zhusuan (Table 3) as the main analysis data.

Table 1. Zhusuan research questionnaire (Source: questionnaire prepared by Yu-Hui Lin).

Zhusuan Research Questionnaire	
This is an academic research on the inclusion of Zhusuan in the Representative List of the Intangible Cultural Heritage of Humanity. The research topics of this report are, as follows: Whether the successful application of Zhusuan for world	
No.	heritage status helped to improve the visibility of Zhusuan? What were the difficulties in the protection of Zhusuan before and after applying for world heritage status? After applying for world heritage status, what opportunities did it bring to the protection of Zhusuan? How should we construct an effective (concrete and feasible) inheritance mechanism?
1	Whether the successful application of Zhusuan for world heritage status helped improve the visibility of Zhusuan?
2	What help did the successful application for world heritage status bring to the protection of Zhusuan?
3	What were the difficulties in the protection of Zhusuan before applying for world heritage status?
4	What were the difficulties and opportunities in the protection of Zhusuan after applying for world heritage status?
5	What protective measures did your unit take after applying for world heritage status?
6	What methods did your unit take to inherit Zhusuan after applying for world heritage status, especially through formal and informal education (such as education, publicity, and ability training)?
7	How could your unit actively absorb the participation of communities, groups, and individuals related to Zhusuan when carrying out protection activities after applying for world heritage status?
8	How should we construct an effective (concrete and feasible) inheritance mechanism?

Table 2. Searching chinese keywords related to zhusuan by google (Source: searched, collected, and tabulated by Yu-Hui Lin/with reference to the supplement by Hui-Chiang Huang's 2016 search data).

Year	Searching Chinese Keywords Related to Zhusuan on Google				
	Key word	算盤	珠算	算盤 文化遺產	珠算 文化遺產
2016	News	323,000	8950	10,400	1600
2019		3,610,000	10,900	8010	2600
2016	All	4,250,000	2,600,000	172,000	63,400
2019		24,400,000	4,650,000	683,000	144,000

Table 3. Searching english keywords related to zhusuan by google (Source: searched, collected, and tabulated by Yu-Hui Lin/with reference to the supplement by Hui-Chiang Huang's 2016 search data).

Year	Searching English Keywords Related to Zhusuan on Google				
	Key word	Abacus	Zhusuan	Abacus Cultural heritage	Zhusuan Cultural heritage
2016	News	73,900	134	736	24
2019		628,000	207	24,100	9
2016	All	17,500,000	9430	736	24
2019		42,600,000	33,800	848,000	2860

Table 2 and **Table 3** show the Chinese and English keywords related to Zhusuan, respectively, as searched in Google by the researcher on August 27, 2019. The relevant information of the work report, as submitted by Hui-Chiang Huang, the representative of the United States, on August 8, 2016, is analyzed in the “Analysis and Discussion” section. In addition, the researcher conducted online interviews with the representatives of different countries and asked the following question: “In the past three years, what were your efforts and contributions to the protection and inheritance of Zhusuan culture?” Then, according to the contributions of the representatives of various countries over the three years, the researcher collated and analyzed the contents.

3. Analysis

The aforementioned questionnaires, as prepared by the researcher, were answered orally (recorded by the researcher) or in e-mails written by the respondents, and then, the respondents' answers were collected and analyzed by the researcher. The questions, answers, and analysis were guided by the “Introduction” in **Table 1**. Introduction: “This is an academic research regarding the inclusion of Zhusuan in the Representative List of the Intangible Cultural Heritage of Humanity. The research topics of this report are, as follows: Whether the successful application of Zhusuan for world heritage status helped improve the visibility of Zhusuan? What were the difficulties in the protection of Zhusuan before and after applying for world heritage status? What opportunities did it bring to the pro-

tection of Zhusuan after applying for world heritage status? How should we construct an effective (concrete and feasible) inheritance mechanism?” According to the questions and answers of the questionnaire survey, the researcher analyzed and discussed the contents, as follows:

3.1. The First Stage: The Protection and Revitalization of Zhusuan

3.1.1. Questions, Answers, and Analysis

- Q1. “Whether the successful application of Zhusuan for world heritage status helped improve the visibility of Zhusuan?”

Answer analysis: the answers to this question are rather polarized. The representatives of China said that the Representative List of the Intangible Cultural Heritage of Humanity is of great help to improve the visibility of Zhusuan, while the representatives of other regions thought it was less beneficial. Hui-Chiang Huang, the representative of the United States (submitted on August 8, 2016), searched for keywords related to Zhusuan through Google and thought it was helpful, but it was limited to Asian and Chinese circles.

- Q2. “What help did the successful application for world heritage status bring to the protection of Zhusuan?”

Answer analysis: the representatives of China said that it raised people’s awareness of protection. Therefore, Zhusuan has been included in primary school mathematics textbooks as a national curriculum standard in China, and the number of students studying Zhusuan and mental arithmetic in schools and private educational institutions has grown significantly. While the representatives of other regions said that it has not received special attention or has not helped.

- Q3. “What were the difficulties in the protection of Zhusuan before applying for world heritage status?”

Answer analysis: the representatives of China said that there are potential risks. As the main protection body of the Representative List of the Intangible Cultural Heritage of Humanity, “the Chinese Zhusuan Association” and its members are mostly non-profit social organizations that rely on government financial allocation. However, the government and non-governmental organizations will soon be decoupled and restructured, which will lead to problems of brain drain, funding insecurity, and even the elimination of institutions. Taiwan is faced with the problems of withdrawing Zhusuan from vocational schools, retired or withered teachers, and the increasingly smaller scale of activities, such as verification and competition; while other regions have long been declining or eliminated.

- Q4. “What were the difficulties and opportunities in the protection of Zhusuan after applying for world heritage status?”

Answer analysis: it is generally believed that there is a new opportunity, and they hope to ride the wind and waves with the title of Representative List of the Intangible Cultural Heritage of Humanity, and thus, create new business opportunities for cultural and educational industries. They are glad to see its success. The representatives of China were cheerful and inspiring, and expressed its bright

future in oral or written answers. Some representatives even thought that “the shortage of teachers cannot meet the development needs of schools”, which shows that the Representative List of the Intangible Cultural Heritage of Humanity continues to be popular in China.

- Q5. “What protective measures did your unit take after applying for world heritage status?”

Answer analysis: the representatives of the mainland answered with the protective measures submitted to UNESCO when applying for the Representative List of the Intangible Cultural Heritage of Humanity, which roughly included “from the establishment of institutions and scientific research to teacher team construction, theory construction, abacus-based mental arithmetic education and teaching standardization school construction, scientific comparative experiments, appraisal competition contents and form reform, to the sorting of ancient arithmetic books for archives management and other aspects of follow-up”. In particular, the Deputy Secretary General of the Taiwan Commerce Association said that “it should be of great significance for countries with different cultures in the world to have one more point of cross-ethnic identity for the continuous introduction of Zhusuan to non-Chinese countries, such as India, the Middle East, and Africa, in recent years”.

- Q6. “What methods did your unit take to inherit Zhusuan after applying for world heritage status, especially through formal and informal education (such as education, publicity, and ability training)?”

Answer analysis: the situation in Taiwan and other regions is the same as before applying for world heritage status, meaning it only discussed the common topics of relevant industries, and stayed within the topics. The representatives of China described in detail that the Zhusuan curriculum is included in the formal curriculum, enrolling in non-formal education has become easier, the learning population grows rapidly, and its prospects are promising.

- Q7. “How could your unit actively absorb the participation of communities, groups, and individuals related to Zhusuan when carrying out protection activities after applying for world heritage status?”

Answer analysis: almost all representatives of Chinese Taipei answered “still the same”, while the representatives of the United States, Hong Kong (China), Malaysia, and other places generally answered that “there was no obvious distinction before and after applying for world heritage status in their promotions abroad”. The representatives of Chinese Mainland said that “the universal education of abacus-based mental arithmetic in Heilongjiang Province is basically carried out in primary schools, and the activities involve various departments, such as finance, education, culture, science and technology associations, education and scientific research, and the Working Committee of Caring for the Next Generation”.

- Q8. “How should we construct an effective (concrete and feasible) inheritance mechanism?”

Answer analysis: most representatives of China answered with the commitments made at that time, meaning when they applied to UNESCO for world heritage status. While the representatives of other regions proposed holding annual Zhusuan and mental arithmetic verification activities, promoting the activities of the abacus-based mental arithmetic culture, trying to integrate forces in the form of chains or alliances, encouraging relevant research, and expanding the academic base of Zhusuan and mental arithmetic, integrating traditional elements, combining cultural creativity, commercialization, marketization, etc.

3.1.2. Analytic Demonstration

To summarize the above analysis, first, compared with China, other regions obviously do not realize the benefits brought by the inclusion of Zhusuan in the Representative List of the Intangible Cultural Heritage of Humanity, which is related to the fact that China previously applied for Zhusuan to be listed. Second, in 2009, “the Chinese Zhusuan Association” submitted the Zhusuan project to UNESCO for the first time, but it was not approved. The “Chinese Zhusuan Association” continued its efforts, and resubmitted it for approval four years later. Finally, on December 4, 2013, “Zhusuan” was approved and officially listed in the Representative List of the Intangible Cultural Heritage of Humanity, thus, becoming the 30th representative work in the Representative List of the Intangible Cultural Heritage of Humanity in China. Third, as an applicant country for inclusion in the Representative List of the Intangible Cultural Heritage of Humanity, China has indeed fulfilled its commitment to protect the Representative List of the Intangible Cultural Heritage of Humanity three years after its successful application, and has played a positive role in the revitalization of the Representative List of the Intangible Cultural Heritage of Humanity.

3.2. The Second Stage: Inheritance and Dissemination of Zhusuan

3.2.1. Data Search and Interview

In addition to transmission by humans, the age of the Internet closely connects the inhabitants of the global village, and the Chinese abacus has expanded to five continents around the world. The data in **Table 2** “Searching Chinese Keywords Related to Zhusuan by Google” and **Table 3** “Searching English Keywords Related to Zhusuan by Google”, as respectively searched in 2016 and 2019, were compared and analyzed. In just three years, the number of searches for the Chinese keywords “算盤”, “珠算”, “算盤 文化遺產”, “珠算 文化遺產”, and the English keywords “abacus”, “Zhusuan”, “abacus cultural heritage”, and “Zhusuan cultural heritage” on the Internet have increased dramatically. Interestingly, the search volume of the Chinese keyword “abacus” increased from 4,250,000 in 2016 to 24,400,000 in 2019, outdistancing that of “Zhusuan”, which increased from 2,600,000 in 2016 to 4,650,000 in 2019. The search volume of the English keywords “abacus cultural heritage” increased sharply from 736 in 2016 to 848,000 in 2019, which shows the status of “tangible culture” (abacus) and car-

ries the “intangible cultural heritage” (Zhusuan) in the hearts of the world, thus, the abacus is worthy of the title of “the fifth great invention of China”.

Over the past 12 years, the researcher has conducted in-depth interviews with a number of elders in the field of Zhusuan, and published a previous paper. Therefore, this paper focuses on interviewees from 2013 to 2019, and the discussion content is mainly used for cross-checking with search data. In China, the “Chinese Zhusuan Association” has actively promoted Zhusuan, and the “Shanghai Association of Abacus and Mental Arithmetic” has implemented the social practice of special education of Zhusuan. De-He Chang, a national inheritor, and Ping Lu et al., the municipal inheritors, have all actively participated in the inheritance of the Zhusuan project in the Representative List of the Intangible Cultural Heritage of Humanity. Taiwan is not inferior in this aspect; Tseng-Yi Yeh has been promoting the brain science of abacus-based mental arithmetic all his life, and Shen Li has devoted his whole life to abacus education and mental arithmetic. Hui-Wan Liao has carried out Evergreen Zhusuan, which includes multiple potential educational developments for the elderly, went to Shanghai to attend training for Evergreen teachers, participated in the Evergreen teacher training and teaching activities of the “Shanghai Association of Abacus and Mental Arithmetic”, and edited the work of *Abacus and Mental Arithmetic for the Brain Fitness of the Elderly*. Yuan-Hsiang Lin, deputy secretary general of the Taiwan Commerce Association, has been supporting non-governmental Zhusuan education for a quarter of a century with the strength of the organization. Hui-Chiang Huang and Carolyn An, who emigrated to the United States, have been engaged in Zhusuan Education in the United States for decades. Cheng-Hua Liao, who immigrated to Canada, teamed up with Taiwanese Cheng-Yan Yang to establish a certification level system for teachers’ professional development, which offers training for grassroots teachers in emerging countries around the world. In Hong Kong, Bai-Ming Wu provided the “KoAbacus” App, which connects a tablet computer with an abacus. In Japan, Hidetaka Miyanaga visited many countries and taught children and adults to assemble their own colorful abacus. As there are many other achievements in Zhusuan science education based on the above, it is impossible to name and detail their contributions one by one. Most contributors are non-governmental, and do not hold the title of “inheritor”; however, they are all important inheritors of “Chinese Abacus”.

With the support of national funds, “the Chinese Zhusuan Association” produced a “Film of Application for World Heritage of Chinese Abacus”, and submitted it to UNESCO. In the film, the following six commitments were made to continue the inheritance of the Chinese abacus and mental arithmetic culture:

- 1) To improve the inheritance mechanism of the heritage and strengthen the training of inheritors; 2) to establish the base and inheritance center for the protection of the Zhusuan culture in the heritage concentration area; 3) to provide students with readers about Zhusuan and abacus-based mental arithmetic; 4) to sort and retain the traditional handmade techniques of abacus; 5) to organize seminars, exhibitions, and competitions at home and abroad; 6) to introduce more

information about Zhusuan.

Based on the researcher's field investigation, the above six commitments were checked: regarding the first commitment, while the whole country is putting forth efforts at present, the inheritance mechanism is not yet complete, meaning it is still superficial, but is sufficient to meet the regular assessments of UNESCO (for the projects listed in the "Representative List of the Intangible Cultural Heritage", the applicant country is obliged to accept the regular assessments of UNESCO to check whether the applicant country has fulfilled its task to protect the Representative List of the Intangible Cultural Heritage of Humanity). The second commitment has indeed been fulfilled, and many museums have been built, such as the "China Abacus Museum" in Nantong City, Jiangsu Province (Nantong Abacus Museum is the most indicative and currently the largest abacus museum in the world), the "Abacus Museum of Cheng Dawei's Former Residence" in Huangshan City, Anhui Province, the "Abacus Museum" in Qi County, Shanxi Province, and the "Guohua Abacus Museum" in Linhai City, Zhejiang Province, which are the four great abacus museums in China that collect and display a large number of abacus relics, as well as other precious archaeological relics. The third to sixth commitments have all been fulfilled.

3.2.2. Cross-Checking

By cross-checking the survey data in the first and second stages, and based on the answers to the above questions, the researcher analyzed an obvious situation; with the exception of the relatively enthusiastic response of China, other regions are generally "insensitive" to the benefits brought by the successful application for world heritage status. The representatives of the United States believe that the promotion of Zhusuan and mental arithmetic abroad does not really belong to protection, but just promotion and inheritance. Thus, there are polarized differences between China and the United States.

Since the "Chinese abacus" was added to the Representative List of the Intangible Cultural Heritage of Humanity, people should continue to create its value for reuse as a human cultural heritage. However, cultural inheritance needs "people" as the interface, while the Representative List of the Intangible Cultural Heritage of Humanity needs "inheritors". How can culture be inherited without "inheritors"? Therefore, the implementation of the "inheritor" system is actually the primary task of Zhusuan cultural inheritance. In fact, the so-called "inheritors" can be Zhusuan science educators; however, as culture is a "man-made phenomenon" (Tsai, 2015), without inheritors, there would be no generation, regeneration, or practice of the culture. Therefore, inheritance is protection; inheritance itself is a protective measure and has a protective effect. Only by improving the inheritance mechanism, and effectively implementing it, can the ultimate goal of cultural inheritance and continuation be achieved. The author believes that Zhusuan can be inherited through scientific education, can be widely used in the fields of innovation and entrepreneurship, and culture can be inherited and spread forever.

Therefore, this paper summarizes the results of the first and second stages of the survey: since 2019, the cultural education of “Zhusuan—knowledge and practices of mathematical calculation through the abacus” has spread from Chinese cultural circles to non-Chinese cultural circles, and the cross-cultural education of Zhusuan and the cultural and educational industry now includes five continents around the world. This not only reflects the role played by the “Belt and Road Initiative” in the Representative List of the Intangible Cultural Heritage of Humanity, it also renders the Chinese abacus a truly world-class item on the Representative List.

Only when cultural inheritance is put into practice in daily life can it bring opportunities for innovation; therefore, based on literature review, the researcher conducted in situ investigations in Taiwan, Hong Kong, Shanghai, Japan, and other places. This study analyzes the practice of Zhusuan after its inclusion in the Representative List of the Intangible Cultural Heritage of Humanity, and explores the turning point in the cultural inheritance of Zhusuan. At the same time, this study anticipates the inheritance and dissemination of the Zhusuan culture in the future, and finally, puts forward concrete and feasible suggestions.

4. Discussion

4.1. From Protection Project to Education Inheritance

Zhusuan has moved from a project in urgent need of protection in the Representative List of the Intangible Cultural Heritage of Humanity towards the inheritance mechanism of educational science. The Representative List of the Intangible Cultural Heritage of Humanity has been perpetually passed on through scientific education and research, and relevant organizations have successively established a relatively sound inheritance mechanism for education inheritance; for example, two international abacus-based mental arithmetic organizations, PAMA and SAMA, led by Zheng-Hui Liao, have begun to promote the certification system for abacus-based mental arithmetic teachers to assist emerging countries in improving their professional skills and establishing good teaching objectives and verification systems in abacus-based mental arithmetic. The organizations plan to further develop and train top lecturers from all over the world, train grassroots abacus-based mental arithmetic teachers around the world, and train a group of lecturers with both academic and professional qualities through a comprehensive training program and curriculum. At present, several Member States have joined in this system, which enhances its professional image. To date, the Shanghai Development Organization has issued more than 100 1-star and 2-star teacher certificates, which affects the promotion and development of the abacus in various countries. It is estimated that professional teacher certification will become the compass of Zhusuan education.

At present, the traditional cultural industries developed from Zhusuan are dominated by the cultural and educational industry of Zhusuan and mental arithmetic. In Taiwan, most are tutoring educational industries, and are mostly

individual educational institutions. While some cultural and educational industries are developing toward the alliance system and multi-point alliance organizations, some of them extend their education to overseas countries, regard Zhusuan education as a career, and expand their education and training institutions. By organizing teacher study activities, conducting Zhusuan and mental arithmetic and mathematical tests, and publishing relevant books, the cultural and educational industry has been gradually formed to create folk economic output value. Lin (2017) said that “the development of Zhusuan is like its folkloric process; after Zhusuan originated, it flourished among the people, and the development history of Zhusuan followed the life history flow of its culture. In different historical backgrounds, different social conditions, and different cultural contexts, Zhusuan has its different developments and applications”.

In recent years, the Overseas Community Affairs Council has selected “culture teachers” to travel overseas for summer teaching activities every year, and this researcher was selected and sent to Manila, the Philippines, as a “culture teacher”. The leader of local overseas Chinese in Manila said that “the Zhusuan course is always the one with the largest number of students who sign up for Chinese culture courses every summer, which is related to the fact that overseas Chinese are Manila’s economic drivers, and overseas Chinese generally believe that learning Zhusuan is helpful for business”. In addition, both Chinese Taipei and Chinese Mainland have spared no effort in promoting cultural exchanges, and non-governmental organizations have also actively promoted Chinese culture overseas. Abacus-based mental arithmetic teachers in Taiwan travel around the world to organize teacher training courses, conduct Zhusuan and mental arithmetic tests, competitions, etc., and bring the abacus and Zhusuan to the non-Chinese community. Cross-cultural education not only promotes Chinese culture, it also brings abundant economic benefits to the cultural and educational industry. According to the researcher’s investigation, there are increasingly more non-Chinese people learning Zhusuan, and the cultural education of Zhusuan is embraced by five continents around the world.

Therefore, the researcher suggests that the development of Zhusuan should move from protecting the Representative List of the Intangible Cultural Heritage of Humanity to education inheritance, in order to make cultural industry more education-oriented, industrialize cultural education, and recreate the value of the Representative List of the Intangible Cultural Heritage of Humanity in the new era.

4.2. From Folk Customs to Cultural Regeneration

Intangible cultural heritage is often related to the tangible cultural assets of the physical state, thus, the relationship between folk customs and intangible cultural heritage is like that between the abacus and Zhusuan; abacus is a tangible culture, while Zhusuan is an intangible culture. Chen (2009) said that “it is difficult to completely separate tangible culture from intangible culture from the pers-

pective of anthropology's holistic view of culture. Tangible culture is often the carrier of intangible culture, and while it is important to protect intangible cultural heritage in terms of ideas and skills, it must not neglect the protection of its material carriers". The researcher believes that, only when folk customs become a part of economic activities, make good use of the folk characteristics of folk customs, establish an effective inheritance mechanism, expand the power of community participation, and model social enterprises, can it continuously activate folk culture, truly implement folk inheritance, and make cultural inheritance sustainable. To some extent, the inheritance and promotion of culture is based on economic conditions, which is also the reason why the world has injected plentiful funds to support cultural inheritance works. Without the support of economic power, the protection based on economic power, and inheritance through the power of policy, human beings can only helplessly witness the gradual decline of traditional culture, and its eventual destruction. Cultural inheritance can be realized by properly constructing the cultural industries of the Representative List of the Intangible Cultural Heritage of Humanity, and making the Representative List itself the leading role of cultural and economic activities, which is also the highest purpose of UNESCO, meaning its vigorous promotion of the protection of the intangible cultural heritage of humankind.

There are also cultural symbols extended from the abacus, such as the traditional folk custom of "Zhuazhou" (first birthday divination ceremony). When a child is one-year-old, the elders will place books, abacus, pen and ink, mascots, and other items with their own symbolic meanings in front of the child for the child to grasp at will, thus, indicating the child's future development or predicting the child's future aspirations. The abacus is always a necessary item for the Zhuazhou ceremony, as it symbolizes wisdom and wealth. Therefore, the researcher suggests that the listing of Zhusuan in the Representative List of the Intangible Cultural Heritage of Humanity should be viewed from the perspective of the folk economy, and the cultural concepts derived from it should be used to construct the cultural industry. Although the cultural industry has its traditions, it should not be confined to the old traditions, meaning cultural assets can be regenerated and reused by adding the concepts and innovations of the new era.

On January 21, 2017, the researcher went to Japan to interview Hidetaka Miyanaga, the current vice president of the "Harima Abacus Handicraft Collaborative Group", and visited the abacus production process in situ. Hidetaka Miyanaga said that, at present, there are four countries that still have abacus manufacturing technology, including Ono City, Hyogo Prefecture, Japan (formerly known as Harima), Zhejiang Province, China, Amsterdam, the Netherlands, and Budapest, Hungary. Half a century ago, Ono had a population of 50,000, and at that time, about 70% of the population (approximately 35,000 people) engaged in abacus manufacturing technology. Nowadays, there are only 100 craftsmen in Ono City engaged in abacus manufacturing, and the oldest one is more than 80

years old. Ono City is proud of its history of more than 400 years of abacus manufacturing, and continues its tradition of Harima craftsmanship. In addition, local bakeries model their products in a manner that combines the abacus with local characteristics.

Therefore, the researcher suggests that, when we remember traditional culture, we should not forget to put “remembering” into cultural and economic activities, construct systematic management standards, and establish effective cultural marketing, in order to revitalize the Representative List of the Intangible Cultural Heritage of Humanity.

4.3. From Folk Economy to Social Practice

The cultural and educational industry of Zhusuan promotes the activation of a folk economy. When a society’s culture and civilization develop to a certain extent, it will begin to consider the vulnerable and pay attention to special education. Ching-Jen Lin, the first doctor of special education for the visually impaired in Taiwan, has guided blind and visually impaired postgraduates to study Zhusuan, and obtained many research results regarding the educational function of Zhusuan in the aspects of teaching and learning applications. Research has found that Zhusuan has the advantages of not needing specific computing tools, not being affected by time or space, or rapid computing requirements, etc. Learning Zhusuan can improve the accuracy of addition and subtraction of children with low vision, and improve their self-confidence in their ability to learn mathematics. Taiwan offers Zhusuan education for blind students, and Japan has redesigned the abacus for the visually impaired. The researcher has seen several types of abacuses designed for the visually impaired at the “Harima Abacus Museum” in Japan. Hidetaka Miyanaga said that the “abacus was introduced to Japan during the Song Dynasty of China.”

In an expert paper, Tien-Chou Chang, a professor of East China Normal University, described the process of introducing Zhusuan into the 2011 “math curriculum standard”, and stated that he witnessed three mentally challenged schoolchildren being able to do two-digit addition and subtraction calculations through abacus-based mental arithmetic. One of the children’s mothers said tearfully that “thanks to abacus-based mental arithmetic, my child can now take money to shop”. Chang said that “the mentally handicapped children did not know Arabic numerals before, but now they can add and subtract by turning to abacus-based mental arithmetic.” (Chang, 2013) Moreover, 28 “Sunshine Homes” have been set up in Shanghai to implement Zhusuan teaching for the mentally handicapped. In 2015, the “Shanghai Employment Service Center for Persons with Disabilities” and the “Shanghai Association of Abacus and Mental Arithmetic” jointly organized a “Sunshine Home abacus-based mental arithmetic teacher training course” to benefit more mentally handicapped people. In Shanghai, under the leadership of two association presidents, De-He Chang and Ping Lu, “Sunshine Homes” had benefited 1260 mentally disabled students by the end of

2018 (Shanghai Association of Abacus and Mental Arithmetic, 2015).

In addition, both Chinese Taipei and Chinese Mainland have turned Zhusuan into mental arithmetic to help the elderly activate and stimulate their brain and nerves, in order to achieve the purposes of strengthening and benefiting their brain through learning Zhusuan and mental arithmetic. On August 6, 2017, the Taiwan Commerce Association held the “Zhusuan Fun Contest for Family” in an auditorium of the New Taipei City Government. While the association had already held mental arithmetic performance activities for the elderly for many years, in 2014, in order to slow down the aging phenomenon of the elderly, the Chiayi Municipal Health Bureau organized “a fun class of abacus-based mental arithmetic for the elderly” to encourage them to exercise their hands and brains, and frequently practice abacus-based mental arithmetic to prevent dementia.

In Taiwan, Hui-Wan Liao has volunteered to guide the elderly to learn Zhusuan and mental arithmetic for many years in her own supplementary education organization. Not only do the elderly learn Zhusuan, mental arithmetic, and finger exercises, in order to activate the cognitive nervous system of the elderly brain, brain mathematics is included in the teaching activities. As the elderly communicate with each other during breaks and after class, the weekly course has become part of the social life for the elderly, which is of great help for elders to achieve their life goals, and improve their interpersonal relationships, and physical and mental health.

Shanghai is a very lively place for the elderly to learn Zhusuan and mental arithmetic. The “Shanghai Association of Abacus and Mental Arithmetic” compiled the learning material package of Abacus and Mental Arithmetic for the Brain Fitness of the Elderly, and the school-based teaching material of Abacus-Based Mental Arithmetic for the Elderly was rated as excellent teaching material for community education in Shanghai. The course of abacus and mental arithmetic for the brain fitness of the elderly was included in the white paper of 2017 Learning Society Construction. The above shows that the results of implementing the abacus as a social practice are wide-spread.

5. Conclusion

According to the above research results, this research puts forward three suggestions: 1) from protection projects to educational inheritance; 2) from folk customs to cultural regeneration; 3) from the folk economy to social practice.

Therefore, the researcher suggests that the business model of “social enterprise” should be introduced into the cultural industry of Zhusuan, which will not only benefit the mentally handicapped, the visually impaired, and the elderly, but also have the dual functions of education and social welfare. As mentioned in the introduction, as UNESCO has evaluated Zhusuan as “having multiple social and cultural functions”, the protection of the Representative List of the Intangible Cultural Heritage of Humanity can be implemented at the level of social practice, which can develop towards a business model that combines cultural industry with social practice.

Acknowledgements

The study was supported by a grant from a major project of philosophy and social sciences research in Hubei Province, China (21ZD130).

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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