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Investigation and Analysis of Pre-service Primary School Mathematics Teachers' Knowledge of History of Mathematics

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Abstract: *This study aims to investigate and analyze the level of knowledge of history of mathematics and the implementation of historical mathematical education among pre-service primary school mathematics teachers, as well as their attitudes and views towards historical mathematical education. Data was collected through a questionnaire survey and analyzed using SPSS statistical software to conclude that the level of knowledge of history of mathematics among pre-service primary teachers is generally low and the implementation of historical mathematical education is not sufficient. Finally, some relevant suggestions are put forward. This study has practical significance for promoting the development of elementary mathematics education in China and improving the literacy of pre-service primary school mathematics teachers.*

Keywords: *History of mathematics; Mathematics teaching; Pre-service primary school mathematics teachers*

1. Background and Significance

Mathematics is a cultural heritage of mankind [1]. "Mathematics Curriculum Standards for Compulsory Education (2011 version)" points out that "mathematics is an important component of human culture"[2]. As an important part of mathematical culture, the importance of the history of mathematics is self-evident.

At present, the educational value and significance of the history of mathematics are widely known. To date, a number of studies have clearly revealed that when mathematics is taught with abstract formulas and algorithms, without studying how these concepts were developed over time, students perceive mathematics as a set of unrelated topics [3], with no connection to other disciplines or to human life [4], believing that mathematics has always existed as presented in their current textbooks [5]. Previous studies propose that history can be used as a cognitive tool [6] in order to capture students' attention and curiosity to learn mathematics [7], promote flexibility and open mindedness in mathematics [8], and enhance the learning of mathematics for both students and pre-service teachers[9]. Specially, it can motivate students to put more effort into learning mathematics, 'knowing that in the earliest stages of invention, many of the mathematical concepts were extremely difficult to refine, understand and accept for even the most gifted mathematicians' [10]. At this point, research reveals that when students learn how mathematicians themselves had many mistakes, doubts, and struggles during their inventions, they understand the power of hard work and determination [11] and feel less frightened while working with difficult problems [12]. Besides, when students realize how mathematical 'notation, terminology, computational methods, modes of expression, and representations' were generated in the past [1], they appreciate the value of mathematical concepts, and develop a positive attitude toward mathematics [5]. Therefore, the current primary school mathematics textbooks have included a "Did you know?" column with related knowledge of history of mathematics. There are already studies on this column in different versions of primary school mathematics textbooks. In addition, in the new version of textbooks, knowledge of history of mathematics points continue to increase with the grade, which also puts higher demands on the knowledge reserves of primary school mathematics teachers. Therefore, for pre-service teachers in primary education, the cultivation of historical mathematical literacy is particularly important. A thorough investigation of the level of knowledge of history of mathematics among pre-service primary mathematics teachers, the ways to acquire knowledge of history of mathematics, and the evaluation of

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the educational value of the history of mathematics has practical significance.

This article will investigate and analyze the relevant situation of pre-service primary mathematics teachers' knowledge of history of mathematics and summarize the current status of the mastery of historical mathematics knowledge among primary education majors, so as to provide targeted suggestions for the pre-service training of primary teachers.

2. Research Questions

The research on integrating mathematical history into mathematics education in China started relatively late. Although textbooks have added many mathematical historical materials reflecting mathematical culture, if teachers do not understand mathematical history, it is like asking them to cook without rice. Therefore, the prerequisite for teachers to integrate history of mathematics into mathematics teaching is that they understand mathematical history themselves. This article will focus on investigating the current status of mathematical history knowledge among pre-service primary school teachers at a normal university (referred to as pre-service primary school teachers below), and exploring their attitudes towards acquiring mathematical history knowledge and the problems faced by integrating mathematical history knowledge into primary school mathematics education.

Specifically, the following key questions are addressed:

(1) What is the current status of mathematical history knowledge among pre-service primary school teachers?

(2) What are the ways for pre-service primary school teachers to acquire mathematical history knowledge?

(3) What do pre-service primary school teachers think about the educational value of mathematical history knowledge?

3. Research Methods

3.1 Sample

As the main source of primary school teachers is students majoring in primary education at various colleges of education in China, there are currently more than ten colleges in Shandong Province offering this major. The selected college for this study began admitting four-year undergraduate students in 2003 and is the first undergraduate-level primary education major in Shandong Province to receive official approval from the Ministry of Education. Additionally, the college's annual enrollment plan for the primary education major ranks among the top in the province, making it a representative institution.

The target population of this study is pre-service primary school teachers who are in their second, third, or fourth year of study in the primary education major. They meet the qualifications of pre-service primary school mathematics teachers. Basic information about the survey respondents is shown in the table 1.

Table 1: Basic Information about pre-service primary school teachers (147 valid questionnaires).

Factor	Level	Number	Ratio
Male	Male	22	14.97%
	Female	125	85.03%
Grade	Sophomore	90	61.22%
	Junior	41	27.89%
	Senior	15	10.20%
Finished Course	Yes	114	77.55%
	No	33	22.45%
Educational practice	Yes	39	26.53%
	No	108	73.47%

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3.2 Survey Questionnaire on the Current Status of Mathematical History Knowledge

By reviewing and analyzing existing research questionnaires related to the topic, referring to the " Compulsory Education Mathematics Curriculum Standards (2011 Edition) ", and using mathematical historical materials from elementary school textbooks as the main content, the framework of the survey questionnaire is designed. The survey content is divided into four parts: The first part is about the basic information of pre-service primary school teachers. It mainly investigates the gender, grade, whether they have taken history of mathematics course, and whether they have participated in internships in elementary schools. The second part focuses on the mastery of mathematical historical knowledge. It mainly investigates whether pre-service teachers have mastered mathematical historical materials in elementary school textbooks. The third part is to investigate the ways in which teachers acquire mathematical historical knowledge. The fourth part is to investigate the attitudes and opinions of teachers towards integrating history of mathematics into mathematics education.

After completing the design of the survey questionnaire, 40 pre-service primary school mathematics teachers were selected to test the reliability and validity of the third and fourth parts of the questionnaire. Reliability analysis was conducted using SPSS, and the obtained Cronbach's Alpha was 0.694>0.6, indicating that the reliability was within an acceptable range, and the questionnaire results were valid. At the same time, the data from the questionnaire were analyzed using the KMO and Bartlett tests in SPSS, and the KMO value was found to be 0.598>0.5, indicating that the questionnaire data were suitable for factor analysis. The Bartlett test result showed a P value<0.05, indicating that the questionnaire was effective.

3.3 Data Collection

This study primarily employed an electronic survey questionnaire to conduct a survey of the research subjects. A total of 147 questionnaires were received from pre-service primary school mathematics teachers, and all 147 questionnaires were valid, resulting in a valid rate of 100%.

Before data processing, the Online survey software had already numbered all valid questionnaires, and specific data such as the option ratio and score statistics for each question were also available, enabling direct analysis through the SPSS statistical software.

3.4 Data Analysis

When processing and analyzing the data, we primarily use statistical software SPSS and utilize statistical analysis methods such as independent samples T-test and one-way ANOVA. Independent samples T-test is employed for reliability analysis, while one-way ANOVA is used for validity analysis.

4. Status Quo Survey and Analysis of Mathematical History Knowledge

4.1 Analysis of the Current Status of Mathematics History Knowledge of Pre-service Primary School Teachers

(1) Analysis of the Mathematics History Knowledge Questionnaire Results

The second part of the survey questionnaire was designed to investigate the mathematics history knowledge of preservice primary school teachers. This section contained a total of 11 multiple-choice questions. Each question was scored out of 10, with a correct answer earning 10 points and an incorrect answer earning 0 points. The maximum possible score was 110 points. In the process of quantitatively analyzing the questionnaire results, a score of 70 or below (i.e., answering fewer than 7 questions correctly) was considered indicative of a lack of familiarity with mathematics history knowledge. The scores of 147 pre-service primary school teachers are detailed in Table 2.

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Table 2: Statistical table of answer scores

Scores	Number	Ratio
10	5	0.03
20	22	0.15
30	30	0.20
40	32	0.22
50	20	0.14
60	11	0.07
70	8	0.05
80	5	0.03
90	2	0.01
100	4	0.03
110	8	0.05
Total	147	100.0

According to Table 2, the mode is 40. Additionally, calculations show that the mean score is 45.92, with a standard deviation of 25.01. Of the 147 participants, 120 were pre-service primary school teachers who reported being unfamiliar with mathematical history, a ratio as high as 81.6%. Furthermore, there were 89 individuals who scored below the mean. These findings reflect the poor state of pre-service primary school teachers' knowledge of mathematical history, even though the questions on this questionnaire were not particularly difficult and were drawn from primary school mathematics textbooks, which pre-service primary school teachers should be familiar with.

To further analyze the current situation, the accuracy of each question's response was tallied and analyzed, as shown in Table 3.

Table 3: Statistical table of scoring rate of each question

Question	1	2	3	4	5	6	7	8	9	10	11
Number	35	98	110	34	48	69	22	84	28	89	58
Ratio	23.8	66.7	74.4	23.1	32.7	46.9	15.0	57.1	19.0	60.5	39.6

Analysis shows that the content tested in questions 2, 4, 5, 7, and 8 pertains to the country of origin for the Tangram, the inventor of the symbol "÷" and the fraction line, the source of the famous problem " Chicken with rabbit cage," and the alternate name for the difficult problem "Goldbach Conjecture". All of these knowledge points belong to the memory category, but the accuracy of responses is not ideal. Only questions 2, 3, 8, and 10 have a score rate of over 50%, while the lowest score rate is in question 7, with a score rate of less than 20%.

The following is a detailed analysis of some of the questions in the second part.

Question 1 is about counting rods, selected from the "Did you know?" section of the first-grade textbook of elementary school mathematics. When students learn about "recognizing numbers and addition and subtraction within 10," they begin by using small sticks to recognize numbers, which is similar to how ancient Chinese people used counting rods to represent numbers. If the teacher introduces this historical material to students and tells them that the decimal system they are learning can be traced back to ancient Chinese mathematics, students can not only feel the long and brilliant history of mathematics but also see the development of mathematical calculation tools and understand the history of numerical writing, which is very meaningful for them. However, as shown in Table 3, the accuracy rate for this question is only 23.8%, reflecting the lack of attention among pre-service primary school teachers to the historical development of mathematical counting methods.

Question 2 is related to the Tangram, an ancient Chinese puzzle consisting of seven pieces. Due to its ability to form countless patterns, the Tangram is also known as an intellectual game and a tool for divergent thinking. Playing with Tangrams can not only develop students' observation and attention skills

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but also cultivate their imagination and creativity. In addition, Tangrams are helpful for elementary school students to understand various geometric shapes, numbers, and other mathematical concepts. However, as shown in Table 3, the accuracy rate for this question is not ideal, with some respondents having played with Tangrams but not knowing that the Tangram originated in China, reflecting a lack of even the most basic understanding of relevant Chinese mathematical history knowledge among pre-service primary school teachers.

Question 6 is selected from the lesson "The Origin of Numbers" in the first volume of elementary school mathematics textbooks for the fourth grade. The textbook introduces that Arabic figures originated from ancient India. As the Arabs brought this kind of numbers to Europe, the Europeans called them "Arabic figures." With development, Arabic figures became the universal numerals. This is a basic fact of mathematical history that pre-service primary school teachers must master. However, as shown in Table 3, more than half of the respondents answered incorrectly, reflecting the lack of knowledge of mathematical history among pre-service teachers. Imagine when a student asks a teacher, "Why are these numbers called Arabic figures?" some teachers may ignore the student's question or give a vague answer, which is extremely derelict.

Question 7: The "Chicken with rabbit cage" problem is a classic problem in elementary school mathematics, which was recorded in "Sunzi's Mathematical Manual" about 1500 years ago. This problem has significant educational value in teaching students mathematical thinking and methods. However, as shown in Table 3, only 15% of students know that this problem comes from "Sunzi's Mathematical Manual." The vast majority of pre-service elementary school teachers have no impression of this problem, let alone understanding and applying it in their teaching.

Question 9 is about "Cyclotomic method", which was invented by the Chinese mathematician Liu Hui and embodies the concepts of limit and transformation, which were very advanced at that time. At the same time, the constant π is a very important topic in elementary school mathematics and belongs to an essential teaching content. Explaining the origin and development of "Cyclotomic method" is helpful for students to understand the concept of π and also has a positive effect on their understanding of the formula for the area of a circle. As a result, teachers should have a complete grasp of this content. However, as shown in Table 3, the correct answer rate is only 19%. Nearly 70% of the participants chose Zu Chongzhi, who was the first mathematician to accurately calculate the value of π to seven decimal places but not the inventor of "Cyclotomic method". This reflects the confusion of most participants about basic mathematical facts.

Based on the analysis of the above questions, the level of mathematical historical knowledge of pre-service primary school teachers urgently needs to be improved.

(2) Analysis of the Differences in Total Scores of the Pre-service primary Teachers' Mathematics History Knowledge Questionnaire across Various Factors

In order to analyze whether factors such as gender, grade, elective history of mathematics course, and internship situation affect the total scores of the pre-service teachers' mathematics history knowledge questionnaire, SPSS statistical software was used to conduct the analysis using two independent sample T-tests and one-way ANOVA. The results are shown in Table 4.

Table 4: Analysis of the Differences in Total Scores of the Pre-service primary Teachers' Mathematics History Knowledge across Various Factors

Factor	Level	Number	Mean	Std	F-value	Significance probability	Conclusion
Male	Male	22	38.64	18.847	1.818	0.180	No significant difference
	Female	125	47.20	25.797			
Grade	Sophomore	90	49.89	27.252	2.046	0.156	
	Junior	41	38.78	20.273			
	Senior	15	43.33	17.995			
Finished Course	Yes	114	45.70	23.648	2.165	0.143	
	No	33	46.67	29.651			
Educational practice	Yes	39	39.47	18.097	1.444	0.231	
	No	108	46.88	25.802			

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(Significance level=0.05)

As shown in Table 4, the F-statistic values of gender, grade, elective mathematics history, and internship for the pre-service primary school teachers' mathematics history scores are 1.818、2.046、2.165 and 1.444, respectively. The significance probability values are 0.180、0.156、0.143、and 0.231, respectively, all of which are greater than the significance level of 0.05. Therefore, it is believed that there is no significant difference in mathematics history scores among the pre-service teachers in terms of gender, grade, elective mathematics history, and internship situation. The main reason is that pre-service teachers generally do not attach importance to mathematics history, and do not pay attention to accumulation in their daily life. Even if they take elective mathematics history classes, it seems to be only for credits. Therefore, the level of mathematics history knowledge is generally not high.

In Question 12 of the questionnaire, "Will you proactively learn mathematics history knowledge?" 85 of the 147 respondents (57.82%) chose "no". This reflects that the attitude of not actively learning among pre-service primary school teachers is an important reason for the low level of mathematics history knowledge.

4.2 Analysis of Ways for Pre-Service Primary School Teachers to Acquire Knowledge of Mathematical History

A multiple-choice question was set in the questionnaire to investigate the ways in which pre-service teachers acquire knowledge of mathematical history. 85% of the pre-service teachers believed that it was through teachers' introductions in the classroom, followed by 40.8% of students who read books related to mathematical history on their own. 55.78% chose elementary school mathematics textbooks, and 48.3% chose online resources. Only 27% of the respondents chose campus and classroom publicity columns, which may be related to the lack of emphasis on mathematical history in their department's publicity.

4.3 Analysis of the Attitudes and Views of Pre-service Primary School Teachers on the Integration of the History of Mathematics into Mathematics Education

The fourth part of the questionnaire includes questions 14-19, which mainly cover three aspects. Question 14 investigates the self-evaluation of the pre-service primary school teacher's level of knowledge on the history of mathematics; questions 15-17 investigate whether the pre-service primary school teachers recognize the educational value of the history of mathematics, and questions 18 and 19 investigate the pre-service primary school teacher's views on the incorporation of the history of mathematics into mathematics education.

Regarding question 14 "How well do you feel you have mastered the knowledge of the history of mathematics?" the answer is as follows:

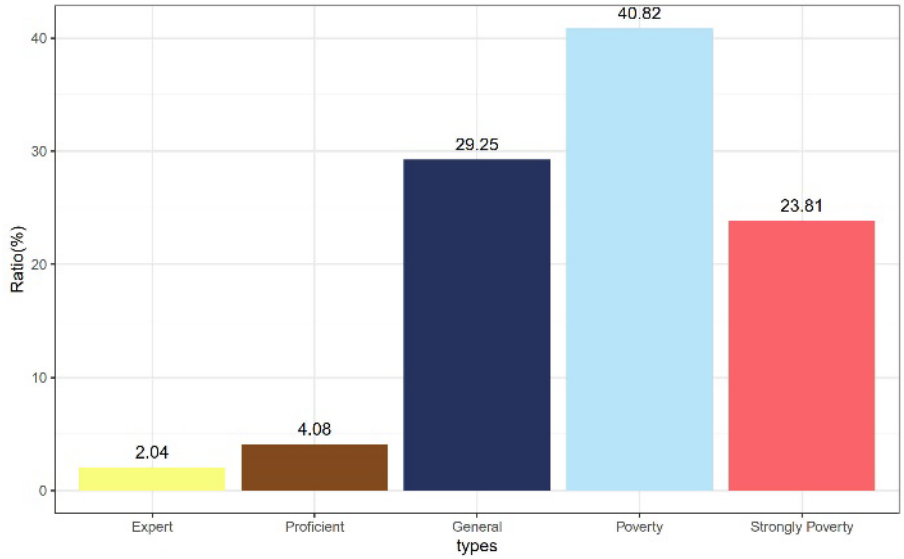

Figure 1: The answer to question 14.

From the above figure, it can be seen that the majority of pre-service primary school teachers are aware of their poor grasp of the history of mathematics, and they have a clear understanding of their own

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situation. This also reflects the necessity for pre-service primary school teachers to improve their level of knowledge of the history of mathematics.

Regarding question 15 "Do you agree with the view that pre-service primary school mathematics teachers should study the history of mathematics?", the answer is as follows:

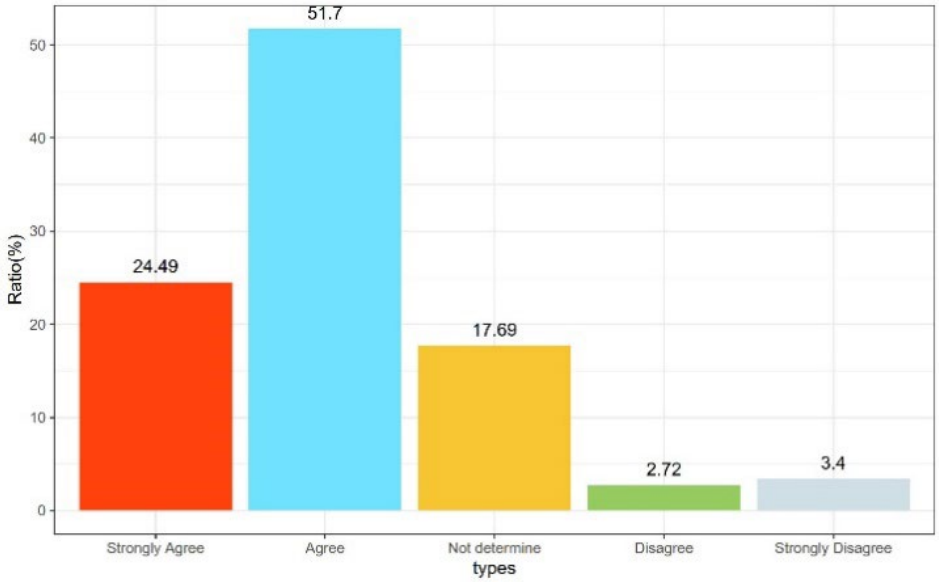

Figure 2: The answer to question 15.

It can be seen that 76% of pre-service primary school teachers agree, while only 6% disagree, reflecting that the majority of pre-service primary school teachers recognize the educational value of the history of mathematics.

Regarding question 16 "What is your opinion on the view that learning the history of mathematics will be helpful for you to become a primary school mathematics teacher in the future?", the answer is as follows:

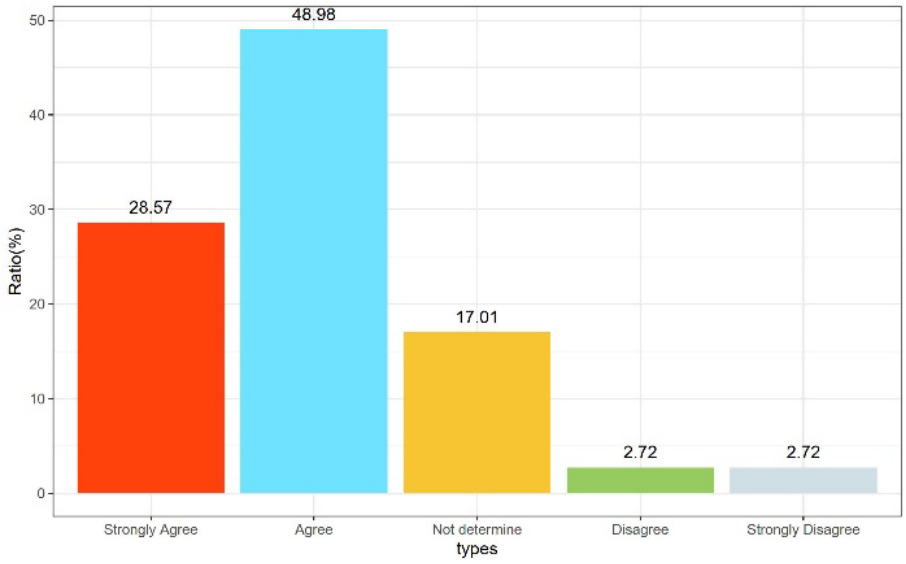

Figure 3: The answer to question 16.

It can be seen that 77.6% of pre-service primary school teachers believe that learning the history of mathematics will be helpful for them to become a primary school mathematics teacher in the future. This also indicates that it is necessary to offer relevant courses on the history of mathematics for students majoring in elementary education.

Regarding question 17 "What is your view on the proposition that knowledge of the history of mathematics is helpful for elementary school students' mathematics learning?", the answer is as follows:

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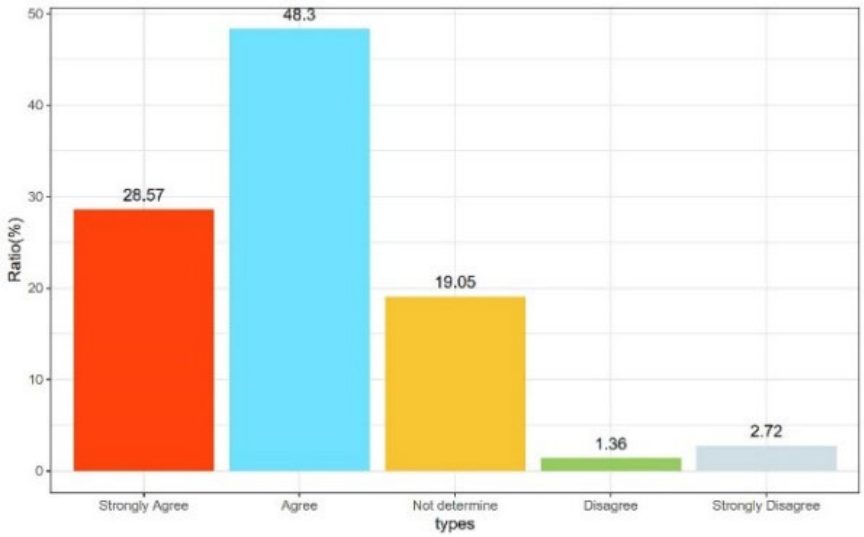

Figure 4: The answer to question 17.

The figure shows that 76.87% of the subjects believe that the history of mathematics is helpful for elementary school students' mathematics learning, while only 4% of the subjects believe that it is not helpful.

Based on the statistical results of questions 15, 16, and 17, it can be reflected that the majority of the subjects strongly agree with the educational value of the history of mathematics.

Regarding question 18: If you are a primary school mathematics teacher, would you integrate mathematics history into your teaching? The answer distribution is as follows:

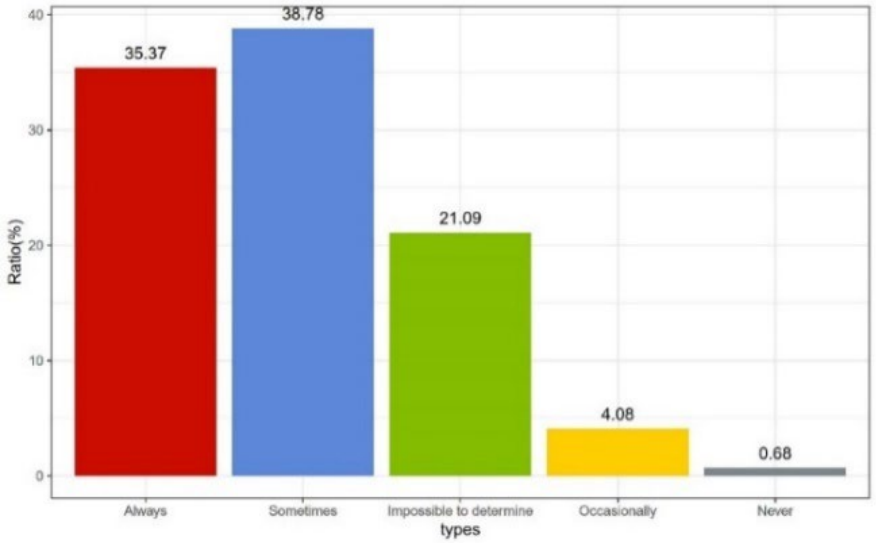

Figure 5: The answer to question 18.

It can be seen that 35.37% of the respondents showed a positive attitude towards integrating mathematics history into teaching, while 38.78% and 21.09% of the respondents chose "occasionally" and "uncertain", respectively. This indicates that more people adopt a wait-and-see attitude towards integrating mathematics history into teaching, which has a lot to do with the low level of mathematics history knowledge among pre-service primary school teachers.

Regarding question 19: Do you think it is necessary to include relevant mathematics history reading materials in mathematics textbooks? The answer distribution is as follows:

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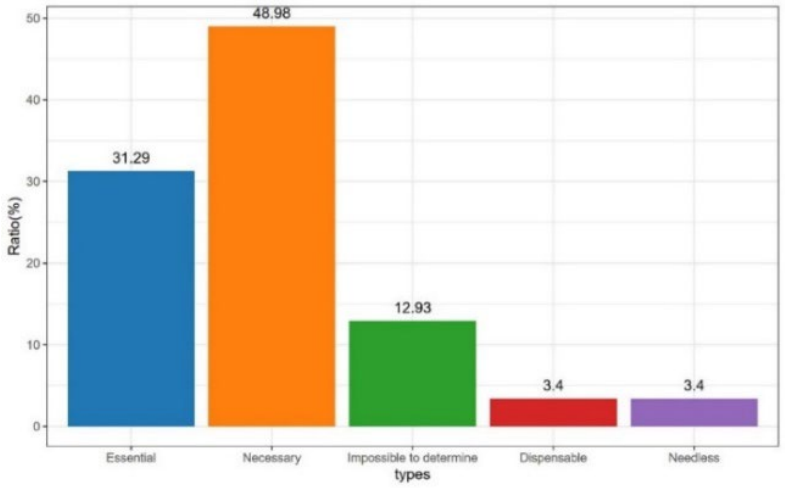

Figure 6: The answer to question 19.

It can be seen that 80.27% of the respondents chose "Essential" and "Necessary". This reflects that most pre-service elementary school teachers have a favorable view of including mathematics history materials in textbooks.

5. Conclusions and Suggestions

5.1 Conclusions

In the new curriculum standard, it is explicitly stated that mathematical culture should be infused into mathematics teaching, and knowledge of the history of mathematics is an important component of mathematical culture. Therefore, it is necessary to attach great importance to the integration of the history of mathematics in mathematics teaching. At the same time, the new curriculum standard also sets clear requirements for the study of the history of mathematics. However, in reality, it seems that the history of mathematics is not valued as much as we expected, and its true role has not been fully realized. Through a questionnaire survey, it was found that the situation is far from what we expected, specifically in the following areas.

The level of mathematical history knowledge of pre-service primary school teachers is generally low.

Through statistical analysis of the questionnaire results, it was found that the average score of pre-service primary school teachers' mathematical history knowledge questionnaire was 45.92, the mode was 40, and the standard deviation was 25.01; 81.6% of pre-service primary school teachers did not reach familiarity (70 points). From this data, it is easy to see that there is an urgent need to change the mastery of primary education majors' mathematical history knowledge. Mathematical history knowledge itself includes many problems such as basic mathematical ideas, basic mathematical methods, and the origin and process of mathematical concepts. From the analysis of each mathematical history question, the overall answer situation of the subjects in the survey questionnaire was poor. Most pre-service teachers did not have enough mastery of mathematical history knowledge related to primary school mathematics, and many common-sense knowledge was not well understood, objectively reflecting the low level of pre-service primary school teachers' mathematical history knowledge.

The main ways to obtain mathematical history knowledge are: teachers' classroom presentations, primary school mathematics textbooks, and online resources.

Investigating the ways in which pre-service primary school teachers acquire mathematical history knowledge is important for understanding the source of their mathematical history knowledge, which has significant implications for researching methods to improve their mathematical history knowledge level. Through investigation, it was found that their ways of obtaining mathematical history knowledge are relatively scattered. Data shows that for pre-service primary school mathematics teachers, the four main ways are: teacher's classroom presentations, reading books related to mathematical history, primary school mathematics textbooks, and online resources.

The attitude towards learning mathematical history knowledge is generally not positive.

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Through analyzing the questionnaire, it was found that the attitude of pre-service primary school teachers towards learning mathematical history knowledge is not positive. According to the results of question 12 of the questionnaire, 57.82% of the subjects stated that they would not actively learn mathematical history. Thus, it can be seen that pre-service primary school teachers generally lack the initiative to learn mathematical history.

It is urgent to set up mandatory courses related to history of mathematics.

In theory, mathematical history courses should be an important way to improve teachers' mathematical history knowledge level. However, we analyzed the mathematical history scores of subjects who have taken mathematical history courses and those who have not. The average score of subjects who took mathematical history courses was 46.67, while the average score of subjects who did not take mathematical history courses was 45.7. The difference between the two is 0.143, which is not significant. This result reflects that the teaching effect of the mathematical history course taken by pre-service primary school teachers is not obvious enough. The reasons include students' lack of emphasis on learning mathematical history, taking the course just to get credits; inappropriate design of the teaching content and teaching methods of the teacher; insufficient attention of the school to the course, etc. Therefore, it is necessary to set up mandatory courses related to history of mathematics for students majoring in primary education.

The differences in mathematical history knowledge level are not significant in many factors.

When analyzing the questionnaire data, it was found that gender has a significant impact on mathematical history scores, with female scores significantly higher than male scores. However, in terms of grade level, there was no significant correlation between the higher grade level and higher mathematical history knowledge level. The decision to take mathematical history courses or not also had no significant influence on their mathematical history knowledge level.

This study is conducted of pre-service primary school teachers majoring in primary education. The purpose is to investigate their current situation and opinions about the history of mathematics during their undergraduate education. The results revealed that, in general, the level of mathematical historical knowledge of pre-service primary school teachers urgently needs to be improved. But they have positive attitudes towards learning history of mathematics, much as previous studies have suggested[13, 14]. In particular, they believe it would be beneficial to learn history of mathematics for both personal and pedagogical aspects.

5.2 Suggestions

Optimizing the structure of the history of mathematics curriculum and strengthening the pre-service education of mathematics teachers on the history of mathematics.

The education of the history of mathematics in Chinese universities started about 20 years ago, primarily in teacher training colleges and some mathematics departments. It developed rapidly, and by 2001, most of the colleges and universities in China had offered elective courses on the history of mathematics. However, with the deepening of the new round of basic education curriculum reform, some problems have arisen in the structure of the history of mathematics courses in primary mathematics education majors in teacher training colleges. Some colleges and universities do not offer relevant courses on the history of mathematics in primary education majors. Moreover, according to survey results, some history of mathematics courses hasn’t been effective in achieving the desired outcomes.

As pre-service teachers majoring in primary education, they need to have a certain level of knowledge of the history of mathematics to meet the requirements of the new curriculum standard for primary mathematics teachers. Relevant departments should follow the requirements of the curriculum reform and set up relevant courses on the history of mathematics. At the same time, a unified and standardized teaching outline should be developed based on the characteristics of the subject, to ensure not only the teaching time but also the teaching content is closely related to the history of mathematics in primary education, thus changing the situation where the history of mathematics course is just a formality and has little effect.

Therefore, the urgent task is to optimize the structure of the history of mathematics curriculum and strengthen pre-service primary school teachers’ education on the history of mathematics, to meet the needs of the basic education curriculum reform.

Teacher education programs for primary education at normal universities should integrate knowledge

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of the history of mathematics into their professional courses.

In addition to offering dedicated courses on the history of mathematics, teacher education programs for primary education at normal universities can also integrate knowledge of the history of mathematics into their teaching methodology and math courses. This approach allows students to understand the historical development of the courses they are learning while acquiring professional knowledge. For example, when teaching skills in math methodology courses, teachers can provide examples of how to integrate math history into the classroom, especially when introducing or explaining certain skills. In math courses, students can be introduced to stories about the inventors of "round-cutting" techniques such as Liu Hui and Zu Chongzhi, as well as classic math puzzles from ancient China, such as the "chicken and rabbit in the same cage" problem and the "Han Xin counting soldiers" problem. This not only broadens the horizons and enriches the knowledge of teacher education students, but also helps them appreciate the humanistic spirit of mathematics, which can stimulate their interest in researching the history of mathematics.

Strengthen the awareness of pre-service primary school mathematics teachers' learning of mathematical history and improve their level of knowledge in mathematical history.

To enhance the awareness of pre-service primary school mathematics majors' learning of mathematical history, certain mechanisms need to be developed. In the teacher qualification examination for primary school mathematics teachers, mathematical history knowledge questions can be appropriately included in the subject of "Mathematics Subject Knowledge and Teaching Ability". Only when students realize that they lack knowledge in this area will they actively seek to learn. Additionally, mathematical history knowledge competitions can be organized during campus activities, and mathematical history experts can be invited to the school to give lectures on special topics. In general, various methods and channels should be used to strengthen the awareness of pre-service primary school mathematics teachers' learning of mathematical history and improve their level of knowledge in mathematical history.

In the long history of mathematical development, mathematics is undergoing significant changes and has become an essential theory and tool for the development of today's society. Mathematics is no longer just about numbers, symbols, and formulas; it has become a basic literacy that every citizen should possess. By incorporating mathematical history and culture into primary education courses, we aim to improve the mathematical literacy of pre-service primary education students. We hope that these prospective primary school mathematics teachers can explore more rich and interesting mathematical materials in their future teaching, so that through their education, every primary school student can receive a good mathematics education and achieve different levels of development in mathematics.

Ethical statement

During the study, all the operations were conducted with the informed consent of the students. In addition, all data collected will be kept confidential and used only for this research project. Any other personal information will be kept confidential and will not be disclosed to anyone without the consent of the student.

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