Asian Journal of Education and Social Studies

Volume 47, Issue 2, Page 30-42, 2023; Article no.AJESS.102484
ISSN: 2581-6268

Research on the Cognitive Degree of Pre-service School Mathematics Teachers for Application Consciousness Literacy

Xiaofan Ma [a] and Zezhong Yang [a*]

[a] School of Mathematics and Statistics, Shandong Normal University, Jinan, China.

Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

Article Information

DOI: 10.9734/AJESS/2023/v47i21019

Open Peer Review History:
This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: https://www.sdiarticle5.com/review-history/102484

Original Research Article

Received: 01/05/2023
Accepted: 03/07/2023
Published: 19/07/2023

ABSTRACT

Currently, the application of consciousness literacy has been widely concerned by all walks of life. Many scholars have studied the cultivation of application consciousness literacy, but there is no research on the cognitive degree of pre-service school mathematics teachers on application consciousness literacy. In this study, 37 postgraduate students of education in a university were investigated, and the cognitive degree of their application consciousness literacy was investigated by open interview. After that, through data analysis, it can be found that: 1. Pre-service school mathematics teachers have a wide range of application consciousness literacy and recognize most of the content; 2. The overall cognitive depth is low, and the cognition is not deep; 3. The overall cognitive clarity is low, and only a few people have a clear understanding of individual points. Therefore, it is suggested that: 1. Application consciousness literacy courses should be added to mathematics education-related majors in colleges and universities to increase their attention; 2. Pre-service school mathematics teachers should have a comprehensive and profound understanding of the relevant content of application consciousness literacy.

**Corresponding author: Email: zhongzee@163.com;*

Keywords: Pre-service mathematics teachers; application consciousness literacy; cognitive degree.

1. INTRODUCTION

Application consciousness mainly refers to the conscious use of mathematical concepts, principles, and methods to explain phenomena and laws in the real world and solve problems in the real world. The application consciousness has important mathematical education value. In 2022, the Ministry of Education of the People's Republic of China promulgated the "Compulsory Education Mathematics Curriculum Standards (2022 Edition)" (hereinafter referred to as the "Curriculum Standards (2022 Edition)"), emphasizing that application consciousness can help students use the knowledge and methods they have learned to solve simple practical problems, develop the habit of integrating theory with practice, develop practical ability on this basis, and clearly point out that we should focus on cultivating students' application consciousness literacy [1]. However, after extensive discussion and research on the cultivation of junior high school students' application consciousness literacy, many scholars and teachers have found that students' application consciousness literacy is not high at present, and the cultivation of application consciousness literacy has not been well implemented in practical teaching. How to cultivate students' application consciousness? Are there specific and feasible training strategies? These questions are worthy of our study.

2. LITERATURE REVIEW

There are many studies on the cultivation of students' application consciousness literacy in junior high school mathematics teaching. By combing the literature, it can be found that the relevant research content mainly focuses on how to cultivate students' application consciousness in and after class. Some scholars have put forward a lot of suggestions on the cultivation strategies of junior high school students' application consciousness literacy by integrating teachers, students, teaching materials, and other factors.

2.1 How to Cultivate the Consciousness of Mathematics Application in Class

Mao, Qi, Lu, and others pointed out that mathematical knowledge is widely used in real life, but some students think that some mathematical knowledge can not be applied to real life, and they are tired of mathematics. Therefore, teachers should contact life examples in teaching, stimulate students' interest, and enhance students' understanding of mathematical knowledge [2-4]. Qi, Zhu, and others pointed out that teachers can set some situations for students in mathematics teaching so that students can solve the problems in a certain situation, and guide students to think more actively [3,5]. Li pointed out that the current junior high school mathematics textbooks attach great importance to the use of knowledge. Teachers should make full use of textbook resources and cultivate students' awareness of application [6].

Lai pointed out that as a highly logical and highly structural subject, mathematics can improve students' thinking ability and computing ability. Students' problem-solving ability is one of the manifestations of thinking ability and computing ability [7]. Wang, Yin, and others pointed out that in the teaching process, teachers can make full use of historical materials to introduce students to the source of relevant mathematical theory knowledge [8,9]. Liang pointed out that teachers should abandon traditional teaching methods, improve mathematics teaching methods, and guide students to connect mathematics knowledge with real life [10]. Yin pointed out that teachers should introduce classroom introductions toward the applied aspects of mathematics [9].

Li pointed out that teachers should choose teaching forms flexibly and pay attention to the effective integration of different subject knowledge and related knowledge [11]. Cheng, Li, and others pointed out that teachers should consciously explore the realistic background of mathematical knowledge and guide students to use the knowledge to explore more practical problems [6,12]. Li pointed out that teachers should guide students to think from the perspective of mathematics, ask questions, and use mathematical knowledge to solve problems [6]. Mao pointed out that in the actual teaching process, communication between teachers and students is very important. Teachers should give students a certain amount of space and time, encourage students to explore boldly and guide students to find and solve problems by themselves. After that, teachers adjust teaching strategies through communication with students

to help students learn mathematical knowledge better [13].

2.2 How to Cultivate the Consciousness of Mathematics Application in Extracurricular Activities

Yang, Li, and others pointed out that teachers should change their teaching concepts. Before cultivating students' application consciousness, they should first enhance their application consciousness, follow the students' cognitive rules, pay attention to the infiltration of thinking methods, and let students gradually form the consciousness of applying mathematics [14,15]. Mao, Liu, Lu, and others pointed out that comprehensive practical activity is a good way to train students to use mathematical knowledge flexibly. Students can gain more mathematical knowledge in the process of activities, enhance their thinking and practical ability, and learn to look at practical problems with a mathematical vision [2,4,16]. Cheng pointed out that teachers should combine in-class and after-class, expand the knowledge learned in class to after class, and provide students with a broad application space [12].

Liang and Lai pointed out that teachers can not only set up after-school exercises with a strong flavor of life according to the actual teaching arrangement but also adopt the forms of papers, weekly journals, etc. so that students can summarize the social problems involving mathematics around them and try to solve them. After the completion of the students, teachers should guide students to better grasp the knowledge they have learned [7,10]. Wang, Wang, and others pointed out that it is necessary to strengthen modeling training to help students master how to convert text into mathematical language, how to convert general problems into mathematical problems， and be familiar with the modeling process [8,17]. Zhu pointed out that teachers should actively carry out the second classroom, use the Internet and multimedia technology, effectively expand the space of mathematics applications, and ensure the effectiveness of junior high school mathematics teaching [5].

From the above research, it can be seen that the previous research on the cultivation strategy of junior high school students' application consciousness literacy has been relatively mature, but it is not difficult to find that few people have studied the application consciousness literacy of teachers, and the research on the cognitive degree of teachers' application consciousness literacy is a blank spot. The improvement of students' application consciousness literacy is mainly realized through classroom teaching in schools, and teachers are a key role in cultivating students' core literacy. Therefore, teachers' professional literacy has a significant impact on students' practical application ability. It can be seen that teachers' cognitive degree of application consciousness literacy is an important factor affecting students' application consciousness literacy. Therefore, this paper aims to understand the current pre-service mathematics teachers' cognitive degree of application consciousness literacy by investigation.

The cognitive degree generally includes cognitive breadth, cognitive depth, and cognitive clarity [18]. Therefore, the main issues of this study are:

1. How wide is the cognitive degree of application consciousness literacy of pre-service school mathematics teachers?

2. How deep is the cognitive degree of application consciousness literacy of pre-service school mathematics teachers?

3. Is the current pre-service school mathematics teachers' cognition of application consciousness literacy clear?

The current research shows that although many strategies have been put forward to cultivate students' application consciousness, the level of application consciousness literacy of junior high school students is not high. Teachers' cognitive degree of application consciousness literacy is an important factor affecting students' application consciousness literacy. Therefore, the hypothesis of this study is:

Hypothesis 1: The current pre-service school mathematics teacher's cognitive degree of the application consciousness literacy is not wide;

Hypothesis 2: The current pre-service school mathematics teacher's cognitive degree of the application consciousness literacy is not deep;

Hypothesis 3: The current pre-service school mathematics teacher's cognitive degree of the application consciousness literacy is not clear.

3. THEORETICAL BASIS

There have been many studies on what the connotation of application consciousness literacy is and what theories are related to it.

Hans Freudenthal proposed that according to the development history of mathematics, the concepts, operations, and rules of mathematics are formed by the actual needs of the real world. Therefore, reality is the source of mathematics, and mathematics should be rooted in reality and applied in reality. This idea is the emphasis on the application of mathematics. Mathematics education should start from the situational problems closely related to the real world, and help students explore mathematical concepts and solve practical problems through specific problems. The content of the mathematics education system is closely related to reality, can be applied in practice, and advocates "realistic mathematics" [19]. In addition, Freudenthal also pointed out that it is the reality of the individual's personal experience that can truly be used as the overall pillar of mathematics [20].

Dewey believes that education is life and school is society. Education is inseparable from life, and life should not be separated from education. By communicating school education with life practice, students can be effectively promoted to use knowledge to solve practical problems. In mathematics education, by introducing vivid life situations, mathematical problems are life-oriented, helping students understand the relationship between life and mathematics, and gradually making students form a good sense of mathematical application [21].

In Piaget's constructive theory, the process of learners' cognitive construction involves two basic processes: "assimilation" and "adaptation". Through these two processes, they find and gradually reach a balance between themselves and the external environment. Therefore, the individual's cognitive process is a dynamic and circular process from balance to imbalance and then to a new balance. The cultivation of junior high school students' awareness of mathematics application should be combined with constructive theory to help students actively construct new knowledge, form, and improve their awareness of mathematics application [20].

With regard to the consciousness of mathematical application, some scholars summarize it as the psychological tendency of using mathematical knowledge from the perspective of psychology. The "application consciousness" is described in the "full-time compulsory education mathematics curriculum standard (Experimental Draft)": students can realize that there is a lot of mathematical information in real life, and mathematics is widely used in the real world; in the face of practical problems, students can take the initiative to try to use the knowledge learned from the perspective of mathematics to find a solution to the problem; in the face of new mathematical knowledge, students can take the initiative to find its realistic background and explore its application value. "The compulsory education mathematics curriculum standard (2011 Edition) " describes the application consciousness as follows: on the one hand, students can consciously use the concepts, principles, and methods of mathematics to explain the phenomena in the real world and solve problems in the real world; on the other hand, students can realize that there are a large number of problems related to quantity and graphics in real life. These problems can be abstracted into mathematical problems and solved by mathematical methods. In the whole process of mathematics education, teachers should cultivate students' application consciousness, and comprehensive practical activity is a good carrier for cultivating application consciousness [22]. " Curriculum Standards (2022 Edition) " proposes that "application consciousness" mainly refers to the conscious use of mathematical concepts, principles, and methods to explain phenomena and laws in the real world and solve problems in the real world. Students can realize that there are a lot of problems related to quantity and graphics in real life, which can be solved by mathematical methods. A preliminary understanding of the application of mathematics as a general scientific language in other disciplines, and the establishment of links between different disciplines through interdisciplinary thematic learning [1].

To ensure the objectivity of the research, this study uses the definition of applied consciousness literacy in the "Curriculum Standards (2022 Edition)" to study the pre-service mathematics teachers' cognitive of application consciousness literacy.

4. RESEARCH METHODS

4.1 Participants

To truly reflect the pre-service mathematics teachers' cognitive degree of the application

Table 1. Content coding

Category		Content
A	**A1**	Mathematical expressions such as functions, equations, and inequalities can be abstracted from specific
Number and Algebra	**Level 1**	life and technological situations
	A2	Be able to discover problems and put forward (or transform them into) mathematical problems from a
	Level 2	mathematical perspective
	A3	Be able to use mathematical thinking to explore, analyze and solve real-life problems in specific
	Level 3	situations, and explain the practical significance of the results
	A4	Be able to know the diversity of problem-solving methods, express and communicate in mathematical
	Level 4	language
B	**B1**	Be able to abstract graphics from specific life and technology situations and conduct research from a
Graphics and Geometry	**Level 1**	mathematical point of view
	B2	Be able to discover problems and put forward (or transform them into) mathematical problems from a
	Level 2	mathematical perspective
	B3	Be able to use mathematical thinking to explore, analyze and solve real-life problems in specific
	Level 3	situations, and explain the practical significance of the results
	B4	Be able to know the diversity of problem-solving methods, express and communicate in mathematical
	Level 4	language
C	**C1**	Be able to collect and process data according to the background of the problem from the actual problem
Statistics and	**Level 1**	
Probability	**C2**	Be able to discover problems and put forward (or transform them into) mathematical problems from a
	Level 2	mathematical perspective
	C3	Be able to use mathematical thinking to explore, analyze and solve real-life problems in specific
	Level 3	situations, and explain the practical significance of the results
	C4	Be able to know the diversity of problem-solving methods, express and communicate in mathematical
	Level 4	language
D	**D1**	Be able to think about real problems from the perspective of mathematics
Integration and Practice	**Level 1**	
	D2	Be able to discover problems and put forward (or transform them into) mathematical problems from a
	Level 2	mathematical perspective
	D3	Be able to use mathematical thinking to explore, analyze and solve real-life problems in specific
	Level 3	situations, and explain the practical significance of the results
	D4	Be able to know the diversity of problem-solving methods, express and communicate in mathematical
	Level 4	language

Category		Content
E Meaning	**E1**	Consciously using the concepts, principles, and methods of mathematics to explain the phenomena and laws in the real world
	E2	Solve problems in the real world
F Main Performance	**F1**	Perception of real life contains a large number of problems related to quantity and graphics
	F2	Be able to solve it by mathematical means
	F3	A preliminary understanding of the application of mathematics as a general scientific language in other disciplines
	F4	Establish links between different disciplines through interdisciplinary thematic learning
G Requirements	**G1**	Focus on the combination of mathematical knowledge and practice
	G2	Understand the quantitative relationship and change the rule in the actual background
	G3	Experience the process of establishing a mathematical model, solving the model, and verifying reflection from practical problems
	G4	Improve the ability to discover, propose, analyze, and solve problems in complex situations
	G5	Enhance the ability to express and communicate logically

consciousness literacy, this study selected 37 masters of education majoring in mathematics of grade 2022 from the School of Mathematics and Statistics of Shandong Normal University as the survey sample. They all have the intention to go to high school for employment in the future.

4.2 Instrument

In this study, the open-ended interview method was used to investigate. Six questions were designed in the interview outline, namely, "Do you understand the meaning of application consciousness? Please elaborate", "How do you understand the application consciousness literacy? Please state your understanding in detail and comprehensively", "Based on the requirements of mathematics curriculum standards, what do you think the application consciousness has an impact on students?", "What problems do you think students may have about application consciousness? What factors lead to?", "What do you think of the application of consciousness in real life?", "What suggestions do you have for cultivating students' application consciousness?". The reason for choosing these questions is to understand the real cognitive degree of pre-service mathematics teachers on the application of consciousness literacy. The open interview method is used because it is fast and convenient, flexible, less restricted by written language, easy to conduct in-depth investigations and obtain the most direct information.

4.3 Data Collection

To ensure the reliability of the research, the open interview method was used to interview 37 postgraduate students one by one, and the interview content was recorded after obtaining the consent of the other party.

4.4 Data Processing

Firstly, the content of the application consciousness literacy in the "curriculum standard (2022 Edition)" is divided and coded. A, B, C, and D are used to represent the four aspects of Number and Algebra, Graphics and Geometry, Statistics and Probability, Integration and Practice respectively. Secondly, 1, 2, 3, and 4 are used to represent the four levels of application consciousness literacy. Finally, E, F, and G are used to represent the meaning and main performance of application consciousness and the requirements that students can meet through the study of the junior high school mathematics curriculum. From this, a total of 7 aspects of A-G and 27 contents of A1-G5 are divided. The specific contents are shown in Table 1. Then the interview recording content is converted into text, the modal particles are removed, and the original words of the interview are sorted out and compared with the encoded content one by one. If the content is similar, the respondents are considered to be able to recognize this. In addition, according to the integrity and accuracy of the respondents' expressions, the level of their cognition is determined. Finally, the number of people mentioned in each item is counted, the corresponding percentage is calculated, and a statistical table is made.

5. RESULTS

5.1 Cognitive Breadth

The content related to application consciousness literacy in the curriculum standards is divided into 27 items, and pre-service mathematics teachers can recognize 24 of them, accounting for 88.89 % of the total. Among them, "Be able to abstract graphics from specific life and technology situations and conduct research from a mathematical point of view", "Solve problems in the real world", and "Focus on the combination of mathematical knowledge and practice" have the largest number of cognitive people, with 37 people, accounting for 100 % of the total number.

From different aspects, "Number and Algebra" is divided into four points, pre-service school mathematics teachers recognize three points; "Graphics and Geometry" is divided into four points, pre-service school mathematics teachers recognize three points; "Statistics and Probability" is divided into four points, pre-service school mathematics teachers recognize four points; "Integration and Practice" is divided into four points, pre-service school mathematics teachers recognize the four points; the "Meaning" of application consciousness literacy is divided into two points, and pre-service school mathematics teachers recognize two points; the "Main Performance" is divided into four points, and pre-service school mathematics teachers recognize four points; the "Requirements" is divided into five points, and pre-service school mathematics teachers recognize four points. Therefore, it can be seen that the current pre-service mathematics teachers have a wide range of cognition on the application of consciousness literacy, but only a few people recognize the individual points. As far as the specific content is

Table 2. Cognitive breadth results

Category		Label	Number	Percentage (%)	Cognitive points	Total points	Percentage(%)
A Number and Algebra	A1 Level 1	A1	35	94.59	3	4	75.00
	A2 Level 2	A2	30	81.08			
	A3 Level 3	A3	32	86.49			
	A4 Level 4	A4	0	0.00			
B Graphics and Geometry	B1 Level 1	B1	37	100.00	3	4	75.00
	B2 Level 2	B2	28	75.68			
	B3 Level 3	B3	25	67.57			
	B4 Level 4	B4	0	0.00			
C Statistics and Probability	C1 Level 1	C1	35	94.59	4	4	100.00
	C2 Level 2	C2	34	91.89			
	C3 Level 3	C3	27	72.97			
	C4 Level 4	C4	4	10.81			
D Integration and Practice	D1 Level 1	D1	34	91.89	4	4	100.00
	D2 Level 2	D2	34	91.89			
	D3 Level 3	D3	33	89.19			
	D4 Level 4	D4	5	13.51			

Category	Label	Number	Percentage (%)	Cognitive points	Total points	Percentage(%)
E	E1	31	83.78	2	2	100.00
Meaning	E2	37	100.00			
F	F1	36	97.30	4	4	100.00
Main Performance	F2	35	94.59			
	F3	11	29.73			
	F4	8	21.62			
G	G1	37	100.00	4	5	80.00
Requirements	G2	35	94.59			
	G3	36	97.30			
	G4	0	0.00			
	G5	8	21.62			

Table 3. Cognitive depth results for four levels and four aspects

	Level 1	Level 2	Level 3	Level 4
Number and Algebra	94.59	81.08	86.49	0.00
Graphics and Geometry	100.00	75.68	67.57	0.00
Statistics and Probability	94.59	91.89	72.97	10.81
Integration and Practice	97.3	97.3	94.59	18.92

Table 4. Cognitive depth results for other content

	Meaning	Main Performance	Requirements
Average percentage（%）	91.89	60.81	62.70

concerned, pre-service school mathematics teachers have a high degree of cognition of the content with a low level of application consciousness literacy and strong generality, such as "Level 1" and "Meaning", but has a low degree of cognition of the content with higher level. Details are shown in Table 2.

5.2 Cognitive Depth

Further analysis of the four aspects of the four levels can be found that from different levels, pre-service mathematics teachers know more about the first three levels, but less about level 4; from different aspects, most of the points they know are concentrated in the aspect of "Integration and Practice", and the understanding of "Graphics and Geometry" is relatively less. At the same time, the average percentage of pre-service mathematics teachers' cognitive points on the "Meaning" of application consciousness literacy is 91.89 %, and the average percentage of cognitive points on the "Main Performance" and "Requirements" is 60.81 % and 62.70 % respectively. Therefore, it can be seen that the current pre-service mathematics teachers have a deeper and more comprehensive understanding of the "Meaning" of application consciousness literacy, while the high-level content of the four levels and four aspects are not fully understood. On the whole, pre-service mathematics teachers' cognitive degree of application consciousness literacy is mainly concentrated at a low level. The details are shown in Table 3 and Table 4.

5.3 Cognitive Clarity

According to the completeness and accuracy of the respondents' expressions, the level of their cognition is determined, and the percentage of the total number of people with high and low cognition is calculated respectively. Through the investigation, it is found that the clearest cognition of the current pre-service mathematics teachers is "Focus on the combination of mathematical knowledge and practice" and "Understand the quantitative relationship and change rule in the actual background". The percentage of cognitive clarity has reached 100.00: 0.00, accounting for 7.41 % of the total points; on the contrary, pre-service teachers' percentage of cognitive clarity is 0.00: 100.00, accounting for 11.11 % of the total points, for the three items of "Be able to use mathematical thinking to explore, analyze and solve real-life problems in specific situations, and explain the practical significance of the results". Therefore, it can be seen that the current pre-service mathematics teachers have a less clear understanding of the application consciousness literacy, and mainly focus on the "Requirements" aspect, while the understanding of most other points is relatively vague. On the whole, the current pre-service mathematics teachers' cognition of application consciousness literacy is relatively vague. The details are shown in Table 5.

Table 5. Cognition clarity results

Category		Label	Percentage of cognitive clarity (high degree: low degree)
A Number and Algebra	A1 Level 1	A1	8.57: 91.43
	A2 Level 2	A2	10.00: 90.00
	A3 Level 3	A3	9.38: 90.62
	A4 Level 4	A4	0.00: 0.00
B Graphics and Geometry	B1 Level 1	B1	16.22: 83.78
	B2 Level 2	B2	7.14: 92.86
	B3 Level 3	B3	0.00: 100.00
	B4 Level 4	B4	0.00: 0.00

Category		Label	Percentage of cognitive clarity (high degree: low degree)
C Statistics and Probability	C1 Level 1	C1	8.57: 91.43
	C2 Level 2	C2	2.94: 97.06
	C3 Level 3	C3	0.00: 100.00
	C4 Level 4	C4	0.00: 100.00
D Integration and Practice	D1 Level 1	D1	23.53: 76.47
	D2 Level 2	D2	8.82: 91.18
	D3 Level 3	D3	12.12: 87.88
	D4 Level 4	D4	20.00: 80.00
E Meaning		E1	45.16: 54.84
		E2	86.49: 13.51
F Main Performance		F1	50.00: 50.00
		F2	85.71: 14.29
		F3	36.36: 63.64
		F4	50.00: 50.00
G Requirements		G1	100.00: 0.00
		G2	100.00: 0.00
		G3	2.78: 97.22
		G4	0.00: 0.00
		G5	37.50: 62.50

6. DISCUSSION

6.1 Cognitive Breadth

From the above data analysis, it can be seen that the current pre-service mathematics teachers have a wide range of cognition on the application of consciousness literacy, but only a few people recognize the individual points. As far as the specific content is concerned, pre-service mathematics teachers have a high degree of cognition of the content with a low level of application consciousness literacy and strong generality, such as "Level 1" and "Meaning", but have a low degree of cognition of the content with higher level. From this, we can see that the current pre-service mathematics teachers have a wide range of cognition of application consciousness literacy. Thus hypothesis 1 does not hold.

6.2 Cognitive Depth

From the above data analysis, it can be seen that the current pre-service mathematics teachers have a deeper and more comprehensive understanding of the "Meaning" of application consciousness literacy, while the high-level content of the four levels and four aspects are not fully understood. On the whole, pre-service mathematics teachers' cognition of application consciousness literacy is mainly concentrated at a low level. From this, we can see that the current pre-service mathematics teachers have a low overall cognitive depth of application consciousness literacy. Thus hypothesis 2 is confirmed.

6.3 Cognitive Clarity

From the above data analysis, it can be seen that the current pre-service mathematics teachers have a less clear understanding of the application consciousness literacy, and mainly focus on the "Requirements" aspect, while the understanding of most other points is relatively vague. On the whole, the current pre-service mathematics teachers' cognition of application consciousness literacy is relatively vague.

Therefore, we can see that the current pre-service mathematics teachers' cognitive clarity of application consciousness literacy is low. Thus hypothesis 3 is confirmed.

7. CONCLUSION

The research shows that teachers' cognitive degree of application consciousness literacy directly affects the formation of students' application consciousness literacy. At present, the level of application consciousness literacy of junior high school students is generally not high, so is it due to teachers' low cognitive degree of application consciousness literacy? To this end, this study selected 37 master's of education graduate students and used the interview method to investigate the pre-service mathematics teachers' cognitive degree of application consciousness literacy. Through investigation and analysis, it can be seen that the current pre-service mathematics teachers: 1. The cognitive scope of application consciousness literacy is relatively wide, but only a few people recognize the individual points. People have a higher degree of cognition of the content with a lower level of application consciousness literacy and stronger generality, but a lower degree of cognition of the content with a higher level; 2. The understanding of the "Meaning" of application consciousness literacy is more in-depth and comprehensive, while the overall cognition of application consciousness literacy is relatively simple, mainly at a lower level; 3. The overall cognitive clarity of application consciousness literacy is low, there are few points with clear understanding, and the understanding of most other points is relatively vague.

According to the above conclusions, it is recommended: 1. College mathematics education-related majors add application consciousness literacy courses, improve their attention, and strengthen the training of pre-service mathematics teachers; 2. Pre-service mathematics teachers themselves should fully and deeply understand the relevant content of application consciousness literacy, clarify the requirements of cultivating application consciousness literacy proposed in the mathematics curriculum standards, participate in training on problems raised [23], and prepare for the implementation in mathematics teaching in the future.

The subjects of this study are 37 masters of education majoring in mathematics of grade 2022. The sample size is relatively small, and it is concentrated in the same grade of the same college. Other types of pre-service mathematics teachers are not involved, and the sample selection range is small. Therefore, in the future, it is necessary to expand the scope of research sample selection, further conduct more in-depth research on the cognitive degree of pre-service mathematics teachers on application consciousness literacy, and combine various research methods in order to find out more detailed, comprehensive, and scientific results.

CONSENT

As per international standard or university standard, Participants' written consent has been collected and preserved by the author(s).

FOUNDING

This research was supported by Shandong Provincial Education Department (Grant number: SDYJG21023).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Ministry of education of the People's Republic of China. Compulsory education mathematics curriculum standards (2022 Edition). Beijing: Beijing Normal University Press, 2022.
2. Mao M. The cultivation of students' application consciousness in junior high school mathematics teaching. Test Questions and Research. 2020;17:66.
3. Qi HY. On the cultivation of students' application consciousness in junior high school mathematics teaching. New Curriculum (Middle). 2019;08:224-225.
4. Lu JQ. On the importance of cultivating the application consciousness of junior high school mathematics teaching. Youth Diary (Education and Teaching Research). 2019;02:177.
5. Zhu L. How to cultivate students' application consciousness in junior high school mathematics. Mathematics World (Late). 2017;09:32-33.
6. Li W. Strengthening the cultivation of application consciousness in junior high

school mathematics teaching. China Science and Education Innovation Guide. 2008;12:79.
7. Lai CR. Methods of cultivating students' application consciousness in junior high school mathematics. Mathematics World (Early Ten Days). 2017;11:47.
8. Wang N. On the cultivation of application consciousness in junior high school mathematics teaching. New Curriculum (I). 2014;03:10-11.
9. Yin HQ. The strategy of cultivating students' application consciousness in junior high school mathematics teaching. Middle School Teaching Reference. 2016;14:55-56.
10. Liang BS. Close to real life, pay attention to application consciousness. Literature Navigation (Mid-term). 2017;03:23.
11. Li WD. On the cultivation of students' consciousness of knowledge application in junior high school mathematics teaching. secondary school curriculum counseling (Teacher communication). 2015;12:22.
12. Cheng YW. Cultivating application consciousness and improving mathematical literacy. The Big World of Mathematics (Mid-term). 2018;08:52.
13. Mao YF. Improve students' consciousness of application and promote students' all-around development-How to cultivate students' consciousness of application in junior high school mathematics. Mathematical World (Junior High School Edition). 2022;03:87-89.
14. Yang PP. Cultivate application ability and improve mathematical literacy. Xueyuan Education. 2019;24:42.
15. Li Y. The significance and ways of cultivating students' application consciousness in junior high school mathematics teaching. China's Off-campus Education. 2015;22:118.
16. Liu SH. On the cultivation of students' application consciousness in junior high school mathematics teaching. Reading. Writing and Calculating. 2020;06:79.
17. Wang XR. The cultivation of junior high school students' consciousness of mathematics application. Xueyuan Education. 2016;11:96.
18. Meng YY, Sun HJ, Zhou X, Yang ZZ. Research on the cognitive degree of pre-service high school mathematics teachers for intuitive imagination literacy. Asian Journal of Contemporary Education. 2022 Feb 14;6(1):16-29.
19. Li FZ. On Freudenthal's thought of mathematics education and its enlightenment. Journal of Ningbo Institute of Education. 2002;04:42-44.
20. Liu H. Investigation and training strategies of junior high school students' consciousness of mathematics application. Liaoning Normal University; 2019.
21. Zhang PY. Investigation and cultivation of junior high school students' consciousness of mathematics application. Hangzhou Normal University; 2021.
22. Zhang D. Connotation and implementation strategy of application consciousness (I). Primary school teaching (mathematics edition). 2018;03:8-12.
23. Erkan B, Kar T. Pre-service mathematics teachers' problem-formulation processes: Development of the revised active learning framework. The Journal of Mathematical Behavior. 2022 Mar 1;65:100918.

Peer-review history:
The peer review history for this paper can be accessed here:
https://www.sdiarticle5.com/review-history/102484