Review Article

Research on the Learning of University Students Majoring in Mathematics in China

Abstract: Recently, the China government has increasingly attached importance to the development of basic science. As the reserve talents to promote the development of mathematics, university students majoring in mathematics have received the attention of researchers for their mathematics learning. At present, there are many studies on students majoring in mathematics, however, few complete reviews and sorting in this aspect. In this paper, the literature analysis method and statistical method are adopted to review the relevant research literature from 2003 to 2022. The following conclusions are drawn: (1) There are three main research aspects about mathematics learning of college students majoring in mathematics: the current situation, the influencing factors, and strategies to help them. (2) Regarding the situation, there is more research on the problems of students majoring in mathematics and a lack of analysis and research on the causes. (3) About the influencing factors, scholars have explored ample influencing factors, and have a certain research basis and depth. But the complete influencing factors and the mechanism of the factors influencing them are still a blank spot. (4) The strategies are mainly aimed at universities and teachers, and the research has put forward some commonly recognized strategies. However, these strategies are broad and general, lacking pertinence for students majoring in mathematics. It is necessary to analyze the causes of problems existing and put forward more targeted suggestions for the students majoring in mathematics to make research more comprehensive and in-depth.

Keywords: Mathematics; University; Learning; Teaching

1. INTRODUCTION

In 2018, the State Council issued Several Opinions on Strengthening Basic Scientific Research in an All-round Way (GF [2018] No.4), which proposed that "we should concentrate on strengthening basic scientific research and give more preference to key basic disciplines such as mathematics and physics". "The size of the universe, the size of particles, the speed of rockets, the ingenuity of chemical engineering, the change of the earth, the mystery of biology, and the complexity of daily use are all without mathematics." The extensive application of mathematics makes mathematics knowledge a basic subject that college students should study well in any case, and it is a subject of lifelong benefit[1]. And mathematics is a subject of constant change and development, and its greater progress requires more professionals with strong mathematical application abilities[2]. In addition, under the background that mathematics has become an important foundation to promote the development of science and technology and other fields, and the country attaches increasing importance to basic science, college students majoring in mathematics have become the main workers in the field of mathematics in the future and the important reserve force for the development and progress of national mathematics. However, at present, college students majoring in mathematics have less time for professional learning, passive attitude, take "dealing with exams" as the purpose of learning mathematics, and lack the ability to flexibly apply knowledge[3]. Most students do not have the habit of independent thinking and do not deeply understand and master the definition, function, and application of basic methods of concepts[4]. Therefore, it is very important and urgent to make an in-depth summary, sorting out and summarizing the previous studies on the mathematics learning of college students majoring in mathematics, to further study the mathematics learning of college students majoring in mathematics. At present, more and more scholars are committed to exploring the current situation of mathematics learning of college students majoring in mathematics from various aspects. For example, Wang explored and thought about the difficulties faced by college freshmen majoring in mathematics in mathematics learning[5]. Wang and other scholars explored the individual differences in mathematics learning

strategies among normal university students majoring in mathematics through questionnaire surveys and interviews[6], and Huang explored how to cultivate the independent learning ability of mathematics major students through the speculative method[7]. Although scholars have explored various aspects in the past, there is no general research on the results of mathematics learning of college students majoring in mathematics. In order to have a deeper understanding of the current relevant research, research deficiencies, and gaps in this field, this paper intends to use the literature research method to summarize and summarize the previous studies. This study not only helps to explore the current research status of mathematics learning for college students majoring in mathematics but also helps to find the deficiencies and unexplored gaps in the current research, so as to help teachers of mathematics majors to better carry out teaching and guide students' learning. More importantly, it helps researchers to grasp the current research status and point out its deficiencies and gaps. Thus, scholars are encouraged to conduct further in-depth research.

The question studied in this paper is: What is the current situation of the research on "mathematics learning for university students majoring in mathematics"? Specifically, it includes the following three questions:

(1) What are the main aspects of the research on "mathematics majors"?

(2) What research methods are used in the current research on "Mathematics learning of college students majoring in Mathematics"?

(3) What are the shortcomings of the current research on "mathematics learning of college students majoring in Mathematics" that can be further studied?

2. METHODOLOGY

2.1 Data Source

This paper adopts the method of literary analysis, and the data mainly comes from the database of CNKI(China National Knowledge Infrastructure). CNKI is the most authoritative document retrieval tool for academic journals in China. It includes all the contents of Chinese journals. This database can ensure the persuasiveness and reliability of the research.

2.2 Data Collection

In the database, search simultaneously with "mathematics majors" and "mathematics learning" as the search term, 37 documents were obtained. After carefully reading the search results one by one, it is found that scholars' research levels are various, involving psychology, education, and other fields. Some scholars also take mathematics majors as a part of science and engineering students to conduct overall research. Faced with a variety of literature, this study adopts the following criteria for screening: (1) Only domestic research documents are selected; (2) Clarify the literature that takes students majoring in mathematics as the research object; (3) In order to ensure the comprehensiveness and timeliness of this paper, the literature of recent 20 years is selected; Through reading one by one, 26 of them were selected according to the screening criteria for data collation.

2.3 Data Collation

Through the intensive reading of documents, taking notes and tabular statistics, extracting keywords and sentences and refining the main points of the article, classifying the selected documents according to the different research contents, and sorting out and recording the research aspects, research methods, and conclusions of each article in different categories, so as to conduct literature research. After sorting out the data, it is preliminarily believed that the current domestic research on students majoring in mathematics is mainly divided into three aspects: the research on the current situation of mathematics learning of students majoring in mathematics, the influencing factors of mathematics learning of students majoring in mathematics, and how to help students majoring in mathematics learn mathematics.

3. RESULTS

According to the induction and analysis of the existing research, the author preliminarily believes that the current research on the students majoring in mathematics is mainly divided into three aspects: the research on the current situation of mathematics learning of students majoring in mathematics, the influencing factors of mathematics learning of students majoring in mathematics, and how to help students majoring in mathematics learn mathematics.

3.1 Research on the current situation of mathematics learning of students majoring in mathematics

Some scholars have researched the learning strategies of current students majoring in mathematics. Pan has researched the learning strategies of normal students majoring in mathematics and found that the use of learning strategies of normal students majoring in mathematics is not high and is at the middle level; There is no significant gender difference in the overall use of mathematics learning strategies; The overall use level of mathematics learning strategies increases from lower grades to higher grades[8]. Some scholars have investigated the problems existing in mathematics learning of current mathematics majors. Liu, Tang, and other scholars found through questionnaires that 49.9% of the students majoring in mathematics and applied mathematics in local normal colleges and universities have learning burnout and are at a medium to a high level; There are significant differences in the level of learning burnout among students of this major with different gender, grade, and training level, and there is no significant difference in learning burnout among students from different places of origin[9]. Yang and others investigated the current situation of mathematics learning of undergraduate students majoring in mathematics and found that the prominent feature of mathematics learning of undergraduate students majoring in mathematics at present is "passive coping", which is embodied in: the proportion of students who can truly learn independently before class is small; Most students' learning mainly depends on teachers' classroom explanations and reference materials, lacking independent thinking; Most students' learning has obvious utilitarian color[10]. In addition, Pu and others investigated the mathematics learning adaptability of local mathematics majors and found that a few students were completely lack of learning capability or weak in their learning ability. At the same time, there was no significant difference in the overall mean value of students' learning adaptability, but there was a significant difference in learning attitude and teaching mode adaptability[11].

Some scholars also investigated the mathematics learning of students majoring in mathematics in minority areas. Li, Chen, and other scholars used the questionnaire

method to take Xinjiang minority university students as the research object and found that minority students have many difficulties in mathematics learning, such as relying too much on the teacher's explanation, weak autonomous learning ability, and lack of understanding of the meaning of mathematics, and analyzed the causes of obstacles in Xinjiang minority university students' learning of mathematics specialized courses[12][13].

Through the collation of the above views, the current domestic scholars' research on the current situation of mathematics of college students majoring in mathematics is mainly divided into three aspects: learning strategies, existing problems, and research on ethnic minorities. The research frequency of these three aspects is shown in Table 1:

Table 1

Research aspect	Learning strategy	Existing problems	Research on ethnic minorities
Frequency	1	5	2

It can be seen from Table 1 that at present, scholars have done more research on the difficulties encountered by students majoring in mathematics in the process of mathematics learning, but less on the learning strategies used in their mathematics learning. At the same time, there is more research on Han college students, but less research on ethnic minorities.

At present, domestic scholars have adopted a variety of research methods in the study of the current situation of mathematics learning of mathematics majors, including questionnaire surveys, interviews, systematic research, and data statistics. Among them, the most used method is a questionnaire survey. The frequency of these four research methods used in different documents is shown in Table 2:

Table 2

Research method	Questionnaire survey	Interview method	Systematic research	Data statistics
Frequency	6	3	1	1

3.2 Research on the Factors Affecting Mathematics Learning of Mathematics Majors

Liu, Yin, and Lei analyzed the influence of students' college entrance examination scores, willingness to apply for the examination, gender, grade, and other aspects on the correlation between their math learning beliefs and the increase in college grades[14]. Yang and others pointed out that the academic performance of professional college students was affected by three factors: learning adaptability, professional commitment, and learning self-efficacy. At the same time, learning adaptability, professional commitment, and learning self-efficacy all predicted academic performance[15]. Wu pointed out that there was a significant or highly significant positive correlation between math scores of math majors and math value and application, math motivation, math attitude, math interest, and math success in emotional factors, and there was a significant negative correlation between math anxiety and math scores[16]. Fan also pointed out that motivation and interest in mathematics learning are also important factors affecting college students' mathematics learning[17].

Through the collation of the above views, at present, domestic scholars believe that there are eight main factors affecting the mathematics learning of mathematics majors, and can divide these eight factors into three categories: positive correlation, negative correlation, and no significant impact. The influencing factors of these eight aspects and their frequency in such literature are shown in Table 3:

Table 3

	positive correlation	negative correlation	Not much impact
learning interest	3		
Learning attitude	3		
Learning habits	1		

Learning adaptability	1		
academic self-efficacy	2		
Learning anxiety		1	
Gender			1
academic motivation	2		

A questionnaire, interview, and scale methods are used in the research on the factors that affect the mathematics learning of mathematics majors. Among them, the questionnaire survey method is the most widely used. The frequency of the above three research methods used in the literature on factors affecting mathematics learning of mathematics majors is shown in Table 4:

Table 4

Research method	Questionnaire survey	Interview method	Scale method
Frequency	3	1	1

3.3 Research on Strategies to Help Math Majors Students to Learn Maths

At present, the research on strategies to help students majoring in mathematics to learn mathematics is mainly put forward from two aspects: universities and teachers.

At the university level, Wang and others pointed out that colleges and universities should strengthen the awareness guidance of students' autonomous learning through regular training, lectures, psychological counseling, and other ways, and reasonably allocate resources, allocate special self-study classrooms, cooperative learning space, open computer rooms, laboratories, and various practice centers to provide students with sufficient learning space, and further enhance the richness of various learning resources, build a rich online learning resource information base, gradually establish a

good campus culture, and create a strong learning atmosphere[18].

At the teacher level, Wang and others proposed that teachers should change their roles to change the previous indoctrination teaching, use heuristic teaching, take students as the main body of the classroom, and strengthen the interaction and communication with students. At the same time, in classroom teaching, we should innovate the traditional teaching methods, and adopt various teaching modes such as inquiry methods, MOOCs, flipped classes, etc[18-21]. Jiao, Duan, and others pointed out that teachers can stimulate the learning motivation of undergraduate students majoring in mathematics by focusing on cultivating students' internal motivation, adopting appropriate situation creation to attract students' interest, timely evaluation, and correctly using strategies such as rewards and punishment, promote students' mathematics learning[22-25].

Through the collation of the above literature, it is found that most scholars have put forward suggestions and strategies to improve the mathematics learning of students majoring in mathematics at the teacher level, and only one document has put forward improvement measures from the school level. Among them, the strategies put forward at the teacher level are mainly divided into five categories, including changing the role of teachers, taking students as the main body, changing teaching methods, carrying out teaching with the method of inquiry and MOOCs, cultivating students' interest in mathematics learning, stimulating students' learning motivation and correctly using the evaluation system. The frequency of these five aspects mentioned in different documents is shown in Table 5:

Table 5

Strategy	Frequency
Change the role of teachers and take students as the main body	3
Change the teaching method and carry	5

out teaching with the method of inquiry and MOOCs	
Cultivate students' interest in mathematics learning	5
Stimulate students' learning motivation	3

In terms of research methods, the research on strategies to help students majoring in mathematics learn mathematics mainly adopts questionnaire survey, interview method, and speculative method, among which the questionnaire survey method is still the most frequently used, and the specific frequency of use is shown in Table 6:

Table 6

Research method	Questionnaire survey	Interview method	speculative method
Frequency	5	2	3

4. DISCUSSION

The research on the current situation of mathematics learning of students majoring in mathematics mainly focuses on the current situation of learning strategies of students majoring in mathematics and their existing problems, of which there is less research on learning strategies and more research on their existing problems. At the same time, from this part of the research, we can see that the current mathematics learning status of mathematics majors is not ideal, and there are certain burnout and attitude problems. This is consistent with the research conclusions of Gao and other scholars[1]. However, it is still a blank spot to analyze and study the causes of such problems among mathematics students.

As for the research on the factors that affect the mathematics learning of students majoring in mathematics, the influential factors mentioned in the article are relatively rich, which indicates that there is a certain research foundation and depth, and all of them have discussed the degree of influence of some of the factors studied on the mathematics learning of students majoring in mathematics, but the number of current research is small, and most of them are based on the analysis of the existing literature

or directly obtained the influential factors through the speculative method, Then explore the relationship between it and mathematics learning of students majoring in mathematics. These influencing factors are not complete. At present, there are no scholars involved in more influencing factors and the path of these factors affecting mathematics learning, which still needs further exploration and research.

As for the research on strategies to help students majoring in mathematics to learn mathematics, the current research is carried out from the two levels of universities and teachers. Among them, the number of strategies proposed for teachers is more and more comprehensive. Changing teaching methods, relying on online platforms such as MOOCs, making full use of network information technology, stimulating students' learning interests and internal motivation, and improving students' learning enthusiasm are widely mentioned and recognized strategies, which are consistent with the research of Jiang and Zhang. However, these strategies are relatively general and broad and do not reflect the pertinence of students in mathematics and mathematics majors, whether at the university level or the teacher level.

5. CONCLUSION

This paper reviewed and analyzed the 26 documents retrieved, and reached the following conclusions:

(1) In the current research on the situation of mathematics learning of students majoring in mathematics, there are few studies on learning strategies, more research on the problems of students majoring in mathematics, and a lack of analysis and research on the causes of such problems of students majoring in mathematics.

(2) To research the factors affecting mathematics learning of mathematics majors, scholars have explored ample influencing factors, and have a certain research basis and depth, but the complete influencing factors and how these factors affect the mathematics learning of students majoring in mathematics are still a blank spot, which needs further exploration and research.

(3)The research on strategies for helping students majoring in mathematics to learn mathematics is mainly aimed at colleges and universities and teachers and has put forward some commonly recognized strategies, however, these strategies are broad

and general, and do not reflect the pertinence of mathematics and mathematics college students.

Therefore, future research must analyze the causes of various problems existing in the students majoring in mathematics, at the same time, to study the factors that affect their mathematical learning more completely, study the influence path of various factors in depth, and put forward more targeted suggestions for the students majoring in mathematics to carry out mathematical learning, to make such research more comprehensive and in-depth. This is conducive to the cultivation of mathematics majors as the reserve force to promote the development of mathematics, thus making certain contributions to the development of mathematics, the basic science, and all disciplines based on mathematics, such as physics and economics.

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