International Journal of Innovation and Research in Educational Sciences
Volume 6, Issue 3, ISSN (Online) : 2349–5219

Analysis of Factors Influencing College Students' Participation in Mathematical Modeling Competition

Yi-Cong Hou[1] and Hui Xu[1*]
[1] Department of mathematics, School of science, Yanbian University, Yanji China.
*Corresponding author email id: 923546080@qq.com

Date of publication (dd/mm/yyyy): 24/05/2019

***Abstract* – Cultivating students' mathematical modeling ability is an important goal of non-humanities majors in colleges and universities. Take a college as an example, this paper designs a questionnaire survey, analyzes the factors affecting college students' participation in the mathematical modeling contest, and puts forward some reflections and suggestions. Through this investigation, we draw a conclusion, and verify the conclusion with SPSS. The main factors influencing college students' participation in the mathematical modeling competition are: attention to modeling, the difficulty of modeling, interest in mathematical modeling and the school's emphasis on modeling. After understanding these influencing factors, some suggestions are put forward from the perspective of students and teachers respectively to encourage students to participate in the mathematical modeling contest in a more effective way and improve their mathematical modeling ability.**

***Keywords* – Influencing Factors, Degree of Attention, Difficulty, Mathematical Modeling Competition.**

I. Raising of Problems

In recent years, the mathematical modeling ability of students has been widely concerned by the community. One of the important goals of national high school mathematics curriculum standard is to cultivate students' application consciousness and innovation consciousness, make understanding and decision on mathematical model contained in objective things, and incorporate mathematical modeling into curriculum standard[1]. With the development of various modeling activities and mathematical modeling contests, colleges and universities have adopted a positive way to cultivate students' mathematical modeling ability. However, any way to improve students' mathematical modeling ability should be based on the current situation of students, in line with their existing cognitive level and understanding of modeling. Therefore, this paper investigates the factors influencing college students' participation in mathematical modeling competition in the form of questionnaire. Only by understanding the factors influencing college students' participation in mathematical modeling, can we better teach them in accordance with their aptitude and find a more appropriate method to encourage students to participate in mathematical modeling competition and improve their mathematical modeling ability [2].

II. Survey Design

1. *Objects of Investigation*

This paper adopts the form of questionnaire and issues the questionnaire to the students of a university in the form of network. The selected survey objects are college students in this university. This university has made some achievements in the mathematical modeling contest in recent years, which is held every year and actively encourages students to participate in provincial contest, national contest and American contest. This survey was conducted among college students of a certain university. Students of all grades were randomly selected in this survey. In order to reduce the error of the experiment, the students were randomly distributed without considering

the influence of gender. The characteristics of the university students are that in recent years, some achievements have been made in the mathematical modeling contest, but many students are not familiar with mathematical modeling, and their overall mathematical level is at a moderate level.

2. *Questionnaire Design*

The questionnaire is divided into questionnaire 1 and questionnaire 2. Questionnaire 1 sets questions from three dimensions. The first dimension is to investigate students' understanding of modeling. The second dimension is to investigate the factors influencing college students' participation in mathematical modeling. The third dimension is the deepening problem of improving mathematical modeling ability. Questionnaire 2 is a practical modeling problem "mathematics in making dumplings" to investigate the level of students' actual modeling ability.

3. *Data Collection Process*

In the first part of the questionnaire, 240 students were given questionnaires in the form of online questionnaires, which were collected one week later. In the second part of the questionnaire, 50 students were randomly selected from the 240 students to conduct the modeling proficiency test for college students, which lasted for 30 minutes. The data collection is based on the fact that the questions of the questionnaire are close to the life of college students, which effectively saves the time of the respondents and does not arouse the negative feelings of the survey. In order to test whether the data of the surveyors are reliable, for example, questions 1 to 4 are similar questions from different angles. These four questions are put together as test samples to test the consistency. The consistency rate of each question is calculated to be greater than 80%.

III. DATA ANALYSIS

Questionnaire 1: The first part consists of four questions, which are investigated from the grade, participation in mathematical modeling contest, understanding of mathematical modeling and how many books on mathematical modeling have been read. Here are the results:

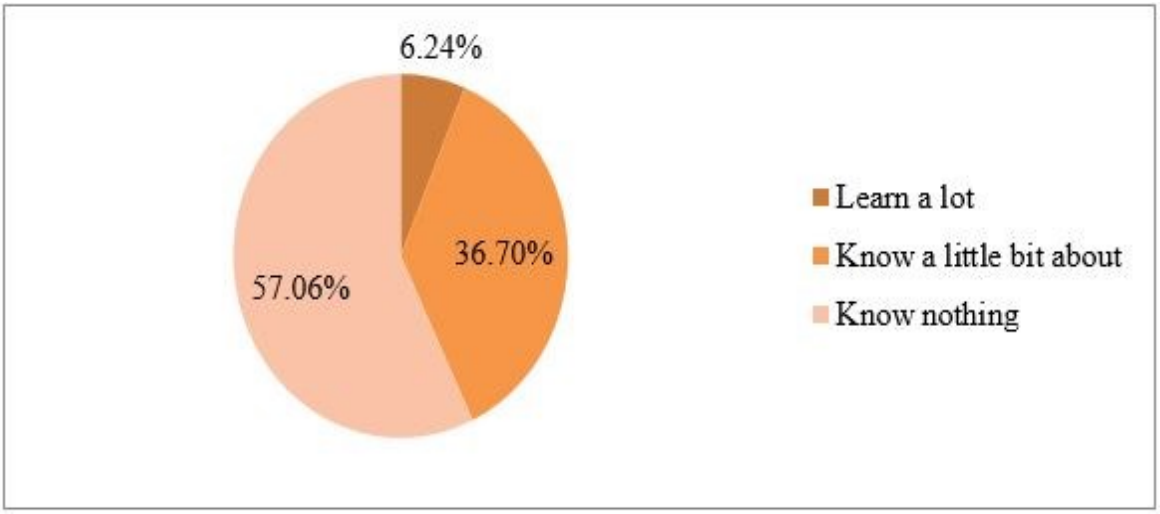

Fig. 1. Knowledge of mathematical modeling

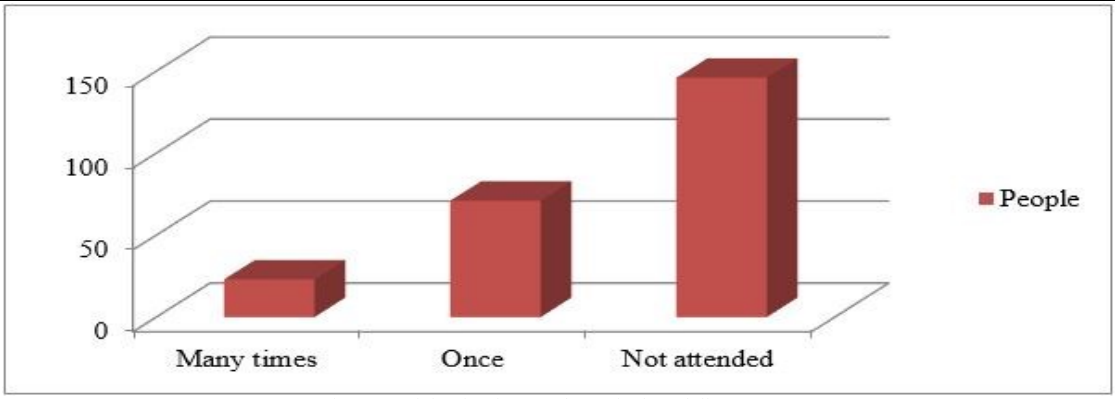

Fig. 2. Participation in a mathematical modeling contest

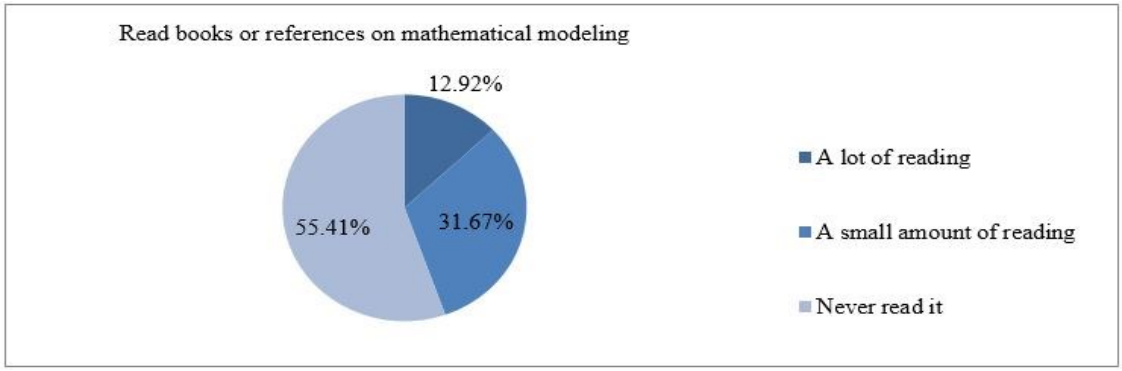

Fig. 3. Reading books or literature on mathematical modeling

Data Analysis Results:

According to the survey results, the enthusiasm of students in the university to participate in the modeling contest is not very high, the competition atmosphere is not strong, the proportion of students who have participated in mathematical modeling is small, and the overall participation of students is not high. The thinking of mathematical modeling has not been implemented in the specific learning of students in the university, and they only know a little about it through various channels. Mathematical modeling trains students not to solve the problem, but to construct mental representations of real phenomena that capture their important and useful features, often visually or symbolically [3]. Therefore, students are required not only to know the table, but also to delve into mathematical modeling and read more relevant books and references.

The problems in the second part are designed according to the analysis of the factors affecting college students' participation in mathematical modeling. The results are shown in the table below:

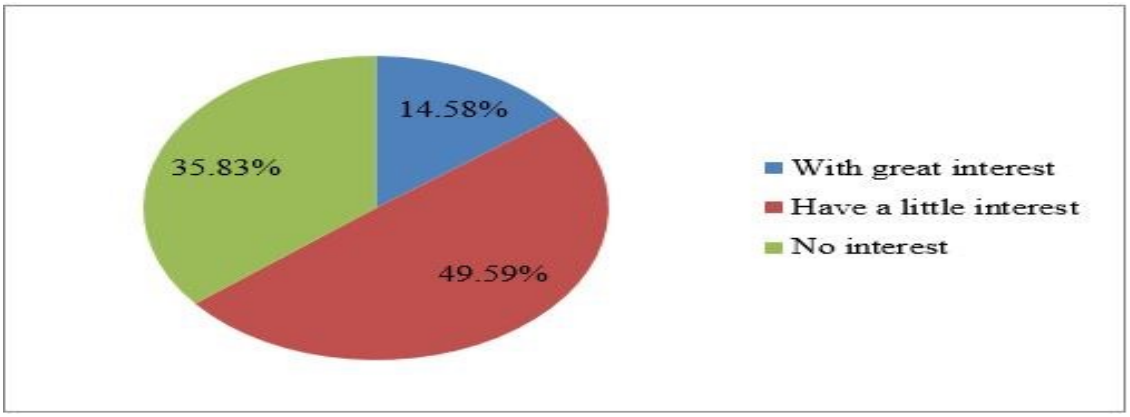

Fig. 4. Survey of interest in mathematical modeling

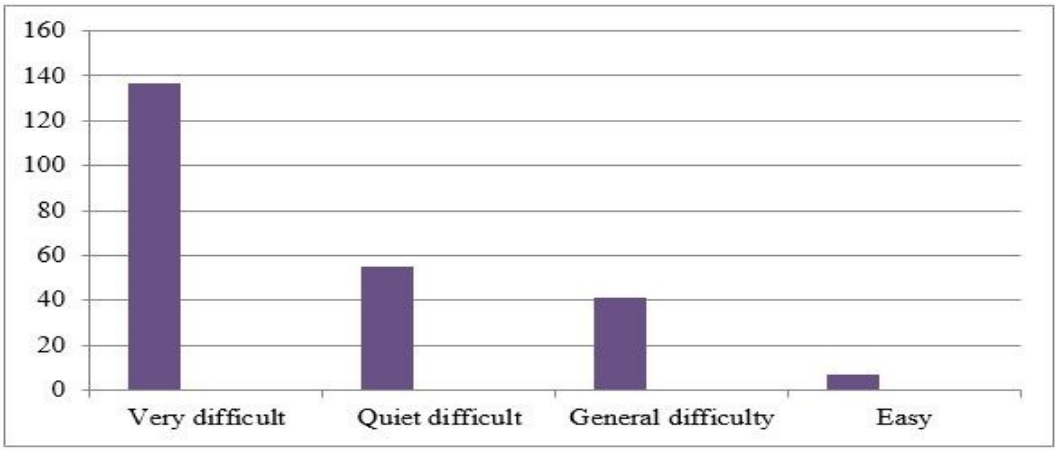

Fig. 5. Survey of difficulty in mathematical modeling

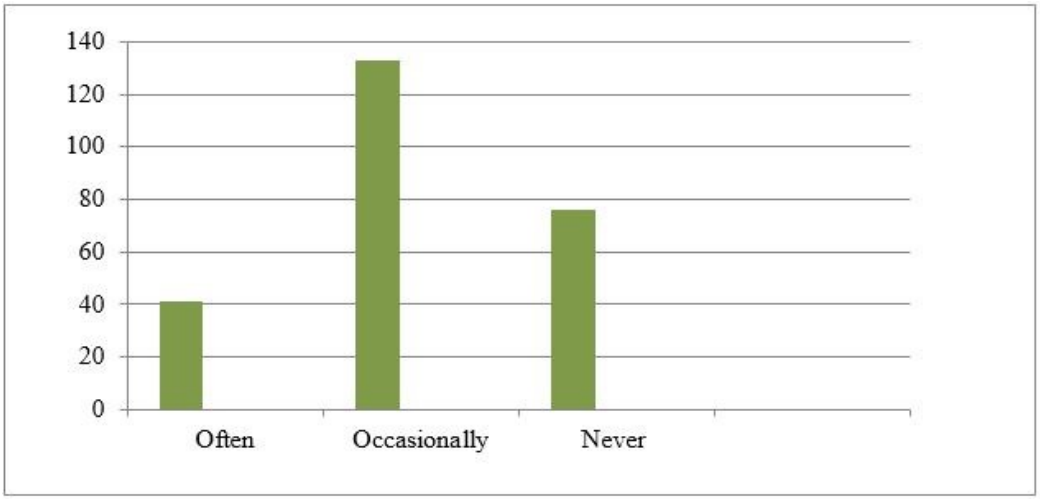

Fig. 6. A survey of interest in mathematical modeling questions and contest results

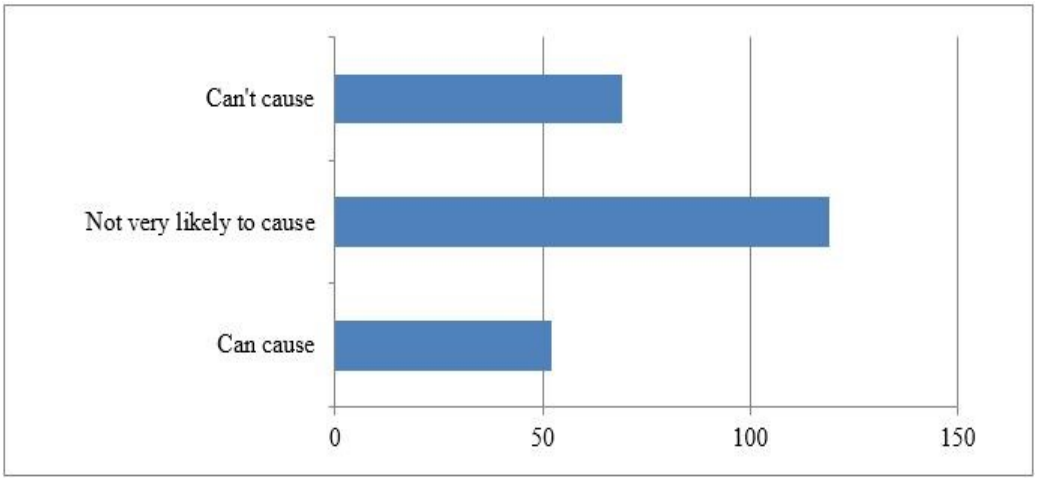

Fig. 7. A survey of interest in mathematical knowledge generated by mathematical modeling

Data Analysis Results:

From the data conclusion of the first part, the data conclusion of the second part can be obtained. The cognition of the difficulty of mathematical modeling, the influence of the environment and the drive of interest lead to the low attention to modeling, which naturally leads to the low proficiency in the application of mathematical knowledge. Mathematical modeling is also unlikely to arouse the interest in mathematical learning. After participating in the competition, I felt that the competition topic was difficult and I had no way to start.

In the second part, SPSS is used for reliability analysis, and the results are as follows:

Table 1. Case processing summary

		N	%
Case	Effective	240	100.0
	Rule out	0	.0
	Sum	240	100.0

Table 2. Reliability statistics

Cronbach's Alpha	Number
.951	5

The reliability is equal to 0.951, indicating that the results of the questionnaire are highly reliable and the data obtained are all real and effective results.

The third part is an open question, which is a deepening question to improve students' mathematical modeling ability. The results are as follows:

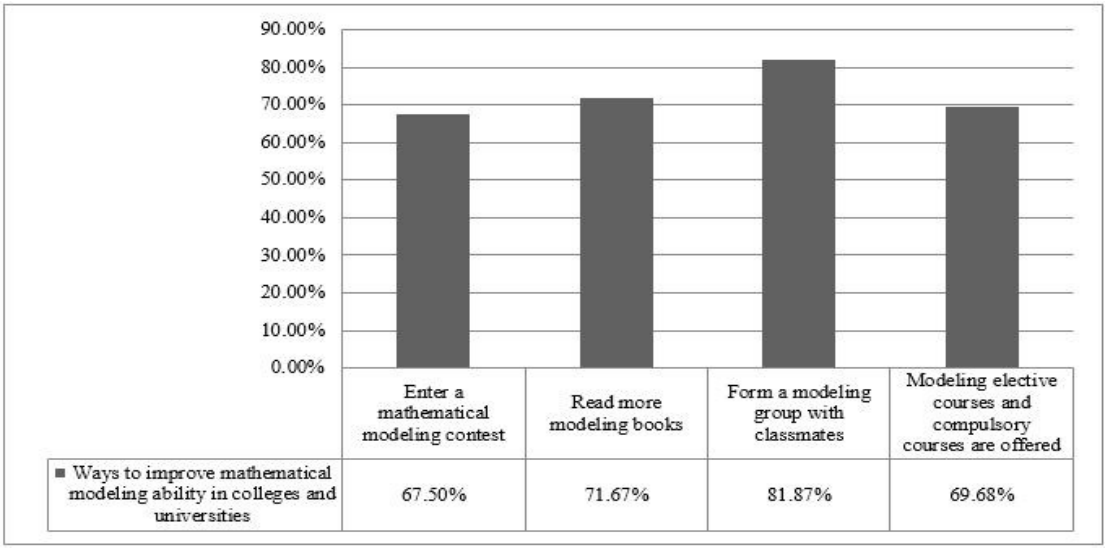

Fig. 8. A bar chart of ways in which colleges and universities can improve mathematicians' modeling ability

Analysis: according to the survey results, participating in mathematical modeling contest, reading more books and papers related to mathematical modeling, establishing mathematical modeling group with classmates to discuss modeling problems, and setting mathematical modeling elective courses and compulsory courses are all good ways for students to improve their mathematical modeling ability. The appeals of students tend to acquire abilities in practice. Among them, it is the most common way to discuss modeling problems with mathematical modeling groups established by students, which indicates that students tend to cooperate, communicate and learn with people with strong mathematical modeling ability, and their modeling ability will also be improved [4].

2. *Questionnaire*

Mathematical problems in making dumplings: usually, 100 dumplings are made at home with 1kg of flour and 1kg of stuffing. Once the stuffing is too much and the noodles do not change, in order to complete the stuffing, should we make each dumpling smaller, more packets, or each dumpling bigger, less packets? We divided the predicted results into six levels:

Table 3. Prediction level of "mathematics in making dumplings".

	Level
Level 0	The questions are blank or the direction of thinking is completely wrong
Level 1	The use of intuitive understanding that large dumplings stuffed with more, but with more dough, can simply use ICONS and other forms to compare the relationship between more stuffing and more dough
Level 2	Try to abstract the actual problem into a mathematical modeling problem, can think of a simple establishment of dumplings volume, surface area and radius of the relationship between, but no further analysis or analysis is not correct
Level 3	ou get the right model, but you don't get the right conclusion
Level 4	To establish the correct model, the conclusion is basically correct, but there are some small details, such as the lack of assumptions that all dumplings are the same thickness of the dough, must be under the assumption that the conditions of the operation or no verification of the actual conclusion.
Level 5	The model is well established and the results are tested and analyzed

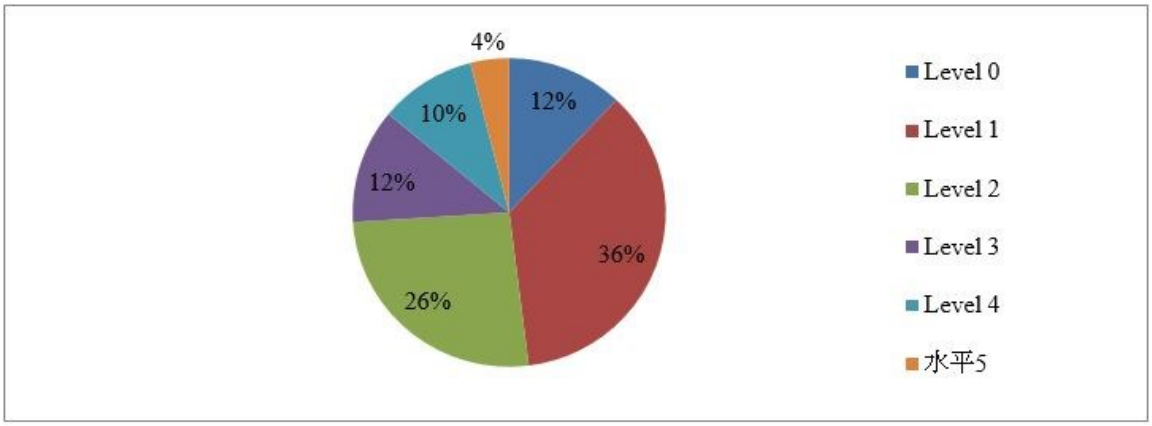

Fig. 9. Percentage distribution of the number of people with mathematical ability in making dumplings

Data Analysis Results:

After calculation, the average level is (6*12% + 18*36% + 13*26% + 6*12% + 5*10% + 2*4%) /6 = 1.905, so it can be seen that the overall modeling level of college students is between level 1 and level 2, close to level 2. Most of the students need to improve their actual modeling ability, which is at the lower level of the first three.

After the completion of the above two tests, we preliminarily believe that the influencing factors for college students to participate in mathematical modeling are: interest in mathematical modeling, difficulty in mathematical modeling, and attention to mathematical modeling. Another intuitive factor is the degree to which schools attach importance to mathematical modeling. SPSS was used to test the correlation and verify this result [5]. Students' interest in mathematical modeling was considered that the difficulty and attention of mathematical modeling were positively correlated with the number of participants.

Table 4. Correlation test of interest, difficulty and concern of mathematical modeling in mathematical modeling competition

		Mathematical modeling interest	Difficulty of mathematical modeling	Mathematical modeling attention
Mathematical modeling interest	Pearson correlation	1	.829**	.859**
	Significance (bilateral)		.000	.000
	N	240	240	240
Difficulty of mathematical modeling	Pearson correlation	.829**	1	.767**
	Significance (bilateral)	.000		.000
	N	240	240	240
Mathematical modeling attention	Pearson correlation	.859**	.767**	1
	Significance (bilateral)	.000	.000	
	N	240	240	240

**. There was a significant correlation at the.01 level (bilateral).

The results show that the correlation is valid, indicating that these factors are indeed factors affecting college students' participation in the mathematical modeling contest.

IV. ADVICE

1. *Suggestions for Contemporary College Students*

Students should be aware of the importance of mathematical modeling, enhance their interest in mathematical modeling, do not be afraid of difficulties, and actively participate in mathematical modeling competition to summarize experience and constantly improve. In the normal learning process, I should truly integrate mathematical modeling into my study and life. In my spare time, I will learn more knowledge about professional mathematical software. I will not only use these mathematical software in mathematical modeling, but also effectively analyze data in my future work, which is also a necessary skill for college students.

2. *Suggestions on how Teachers should teach and how schools should Cultivate Students' Mathematical Modeling Ability*

In daily teaching, teachers should start from textbooks and combine textbooks to explore the modeling ideas contained in textbooks. Teacher himself to broaden their knowledge, have the guide function of the teaching material, teachers should also broaden the thinking to create more modeling situation, the students with specific fact in life such as water-saving washing machine, congestion in the morning and evening peak can be abstracted as mathematics modeling [6], let the students understand mathematical modeling is closely linked with our life. Teachers can also explain the excellent cases of mathematical modeling to students, for beginners to learn other people's excellent modeling ideas is helpful to develop their own modeling thinking.

The school should provide every student with the opportunity to learn mathematical modeling, reasonably arrange mathematical modeling courses, and enhance students' attention to modeling. In each kind of mathematics modelling competition study calls on schoolmates to participate enthusiastically. To strengthen the training of students' mathematical software, we can set up mathematical software associations with professionals to carry out mathematical software teaching and make full use of computer tools to carry out mathematical modeling. Students

can also be encouraged to set up mathematical modeling groups and cross-disciplinary groups to learn and communicate with each other. In the past, education often focused on the results rather than the process, but the cultivation of mathematical modeling ability is just the opposite. Mathematical modeling is the process of learning the entire construction model [7], which requires cooperation from many aspects.

V. Conclusion

According to the survey, we come to the conclusion that the main factors affecting college students' participation in the mathematical modeling contest are: attention to modeling, the degree of difficulty in modeling, students' interest in mathematical modeling, and the school's emphasis on modeling. The investigation also reflects the modeling ability of college students is generally not very high, most of the stay in a certain model of thinking, can build a mathematical model of some simple but practical problems cannot be converted to mathematical problems, to solve this problem myself and will encounter many difficulties, therefore, improving the capacity of mathematical modeling is not happen overnight, need various efforts.

VI. Follow-Up Research Progress

After finish the survey, timely feedback to the school, the college students to take part in mathematical modeling is improved, the specific circumstances are as follows: first, the school increased publicity, held a lecture about mathematical modeling for the students to have a more profound knowledge of mathematics modeling, has just been mathematical modeling of the province and the registration number is 132 more than last year. Secondly, the school has set up a mathematical modeling club, in which professional teachers answer questions about mathematical modeling for students, and students in the club can make progress together through communication and learning. Finally, the school has also opened the optional course of mathematical modeling, which provides a learning platform for all the students. As long as they are interested, they can choose this course for further study. This is a good start, as long as it continues to advance, I believe that the university students will become more and more interested in mathematical modeling and achieve better and better results in the mathematical modeling contest. It is a very beneficial attempt to carry out mathematical modeling in higher education reform. Through unremitting practice and exploration, the education and teaching system of "popularization, classroom teaching, extracurricular practice, research and discussion, promotion and application, distinctive characteristics" is formed, which is also an effective way for colleges and universities to promote talent cultivation.[8]

References

[1] Lin-li. Teaching and learning of mathematical modeling in middle school [D] fuzhou: fujian normal university, 2003, 4.
[2] Xiang-Yu Sun. Investigation and analysis of mathematical modeling ability of Shanghai high school students [J] classroom and teaching: education measurement and evaluation, 2016, 6:44-48.
[3] Ming-Zhen Li. Cognitive research on mathematical modeling [M] nanjing: jiangsu education press, 2013:268-284.
[4] Xian-Yong Huang, Wen-Shan Chen. Investigation and analysis of mathematical modeling ability of undergraduates [J] college mathematics, 2014, 12: 22-25.
[5] lin-li, Hospital data analysis based on SPSS software [J]. Journal of medical informatics, 2015, 36 (5) : 35-38.
[6] Ying-Jie Chen. Investigation and analysis of mathematical modeling ability of Harbin high school students [J] Harbin normal university, 2017, 6.
[7] Dong-Mei Liu. Research on mathematical modeling contest and teaching strategies for college students [J] shandong normal university, 2008, 4.
[8] Hui-Huang Practice and exploration of mathematical modeling activities in higher financial institutions [J] Journal of higher education, 2019, 4.

AUTHORS PROFILE

First A. Author
Yi-Cong Hou 1998, student study in the department of mathematics in Yanbian University (Yanji China).
email id: 923546080@qq.com

Second B. Author
Hui Xu: Associate Professor and master tutor of mathematics department, School of science, Yanbian University. Main research directions: mathematics education technology, mathematical modeling, intelligent algorithm. email id: sxxuhui@ybu.edu.cn