

# **Study on the Degree of Pre-service Teachers' Cognition of the Causes and Solutions of "Understand Immediately When Hearing, but Fail Immediately When Doing"**

**ABSTRACT:** "Understand immediately when hearing, but fail immediately when doing" is a prominent problem for middle school students in the process of learning mathematics at present. The causes of this phenomenon and how to effectively solve it have received extensive attention from all aspects of society, such as teachers, parents, and students themselves. This study took 31 master's students in education and undergraduates majoring in mathematics in a university as the survey objects, and used the interview method to investigate their views on the causes of this phenomenon and how to solve this problem. Through data analysis, it can be found that in terms of causes, 64.52% of the respondents believed that the cause of this phenomenon was "students did not have a profound understanding", and only the number of holders of this view among all the causes exceeded half; in terms of solutions, 77.42% of the people believed that "students should practice more", and this view was also the only one with more than half of the respondents. It can be concluded that most pre-service teachers believe that the causes and solutions of the phenomenon mainly lie with the students. At the same time, it can also be seen that most pre-service teachers lack the awareness of teaching reflection. It is suggested to strengthen and improve the reflection awareness and ability of pre-service mathematics teachers on their own teaching methods through training. Secondly, pre-service mathematics teachers should realize that some of their teaching methods are wrong and ineffective for students. Finally, pre-service mathematics teachers should constantly learn teaching methods and practice according to the different characteristics of students.

**KEYWORDS:** pre-service mathematics teachers; problem-solving ability; degree of cognition

## **1. INTRODUCTION**

The problem of "Understand immediately when hearing, but fail immediately when doing" is widespread among middle school students in the process of learning mathematics. This phenomenon has become a huge problem faced by teachers in middle school mathematics teaching, and it is extremely urgent to solve this problem. In this context, we have to wonder what are the reasons

behind this phenomenon? How can we effectively solve this problem? Is the increasing prevalence of this problem due to the fact that everyone's analysis of the reasons is not thorough and comprehensive? To date, many scholars have conducted research on the causes and countermeasures of this phenomenon, but there is no research on the degree of cognition of pre-service mathematics teachers on the reasons for students' "Understand immediately when hearing, but fail immediately when doing" in mathematics learning. Therefore, this study takes pre-service mathematics teachers as the survey objects and conducts a study on the degree of cognition of pre-service teachers on this issue.

## **2. REVIEW OF THE LITERATURE**

Currently, research on students' mathematics learning mainly focuses on why students understand but cannot do exercises, the factors influencing middle school students' mathematics learning achievements, and how to enable students to understand and solve problems. Researchers have analyzed students' current mathematics learning situation and the influencing factors in subjective and objective aspects through various methods, and have proposed corresponding strategies to help students learn mathematics and improve their mathematics learning achievements.

Most scholars analyze the causes of this phenomenon from both the teaching aspect of teachers and the learning aspect of students and propose corresponding countermeasures. For example, in the article "Analysis of the Causes and Countermeasures of the Phenomenon of 'Understanding but not Being Able to Do' in Mathematics Teaching" by Mao Xirong, the phenomenon of "understanding but not being able to do" of students was deeply studied and analyzed from both the teacher and student aspects. The reasons on the teacher's side for causing this phenomenon are that teachers did not design teaching based on students' cognitive levels and comprehension abilities, the teaching pace was fast, no thinking time was provided for students, and no problem-solving methods were taught to students. The reasons on the student's side are that students lack initiative, have improper learning methods, and have bad learning habits. Corresponding countermeasures were proposed that in concept teaching, teachers should deeply explore the connotation and extension of concepts, allow students to experience the formation process of knowledge, and guide students to think actively<sup>[1]</sup>. In the article "The Causes and Countermeasures of the Phenomenon of 'Understanding but not Being Able to Do' in Mathematics Learning" by Wu Yujin, an analysis was conducted from the teacher's aspect, pointing out that the reasons for causing this phenomenon are not giving full play to the main role of students, not strengthening the connection of knowledge before and after, and not fully exploring mathematical thinking methods. Corresponding countermeasures were proposed that teachers should take students

as the main body in the teaching process, pay attention to the connection of knowledge, pay attention to the mastery of students' mathematical thinking, and increase interaction in the classroom<sup>[3]</sup>. In the article "The Causes and Countermeasures of the Phenomenon of 'Understanding but not Being Able to Do' for High School Mathematics Students" by Wang Weirong, the reasons for causing this phenomenon were analyzed from both the teacher and student perspectives. It was pointed out that teachers focused on imparting knowledge rather than the application of knowledge in teaching, and the explanation and analysis of examples were not in place. Students did not strengthen the application of knowledge, and their thinking in applying knowledge was not flexible. Effective strategies such as teachers supplementing appropriate examples in teaching, formulating exercise plans for students, and promoting students to form a good knowledge structure were proposed, aiming to effectively improve the quality of mathematics classroom teaching and strengthen students' application ability of mathematics knowledge<sup>[4]</sup>. In the article "Analysis of the Causes and Countermeasures of 'Understanding but not Being Able to Do'", by Lu Gangjun, the reasons were analyzed from both teaching and learning aspects. It was pointed out that there were three reasons on the teacher's side in teaching: "imparting much knowledge but demonstrating few examples", "discussing more about the topic but providing less guidance methods", and "teachers talking much but students thinking little". There were three reasons on the student's side: not having a deep understanding of knowledge, having a low thinking ability, and having a weak will to overcome difficulties. Corresponding strategies were proposed that teachers should pay attention to the explanation of examples, handle the relationship between examples and exercises well, and students should improve their mathematical thinking ability<sup>[5]</sup>. In the article "Analysis of the Phenomenon of 'Understanding but not Being Able to Do' from Both Teacher and Student Perspectives" by Zhang Yongchang, aiming at the fact that the mathematics college entrance examination questions are becoming more and more "flexible", but the phenomenon of students "understanding but not being able to do" is becoming more and more obvious. The main reasons are: on the student's side, the basic knowledge is not solid, the auxiliary graphics cannot be applied proficiently, and the induction and summary of knowledge and methods are not timely; on the teacher's side, ignoring the actual needs of students, lacking variant training in the classroom, and not permeating problem-solving methods enough. An analysis was conducted with the help of examples<sup>[6]</sup>. In the article "Why Can't We Do Exercises After Understanding the Class" by Zhang Chunling, the reasons for this phenomenon were analyzed. The main reasons are that students have poor basic skills, mathematics is inherently difficult to understand, teachers focus on imparting knowledge but not cultivating ability, and students lack the spirit of exploration.

Corresponding solutions were proposed that teachers should grasp students' foundation, pay attention to students' learning laws and characteristics, develop students' mathematical thinking ability, and cultivate students' spirit of continuous study<sup>[7]</sup>.

There are also many scholars who have conducted research on the countermeasures for effectively solving this phenomenon. For example, in the article "Improvement Strategies for the Phenomenon of 'Understanding but Not Being Able to Do' in Senior Grade Mathematics" by Chen Suzhe, based on his own teaching practice experience, he analyzed the causes of the phenomenon of "understanding but not being able to do" in senior grade mathematics in primary school. It was pointed out that teachers' teaching methods were outdated, they focused on imparting knowledge but not cultivating ability, they prepared lessons but not students, and ignored the dominant position of students. Students did not preview before class, lacked the spirit of exploration, and lacked initiative and enthusiasm. Countermeasures were proposed that teachers should change their teaching ideas and innovate teaching models, and students should preview before class and be diligent and inquisitive<sup>[8]</sup>. In the article "Strengthening the Understanding of 'Learning and Understanding' and Avoiding the Risk of 'Not Being Able to Do'" by Liu Yongxia, aiming at the widespread phenomenon of "understanding but not being able to do" in high school mathematics classrooms, which seriously affected students' academic performance and weakened their enthusiasm for learning, the reasons for this phenomenon were analyzed. The "understanding" of students was very superficial. Teachers emphasized memory over understanding, results over processes, and skills over general methods. Corresponding countermeasures were proposed that in teaching, teachers should further explain and communicate knowledge, lead students through the formation process of formulas, slow down, give students time to think and explore, guide students through the process of knowledge formation and development, and teachers should attach importance to general method teaching and appropriately expand and improve on the basis of mastering the general method<sup>[9]</sup>. In the article "Breaking Through 'Understanding but Not Being Able to Do' and Improving Problem-Solving Efficiency" by Shao Chunyan, combined with specific topics, some strategies were proposed to help students improve problem-solving efficiency, such as returning to definitions, applying formulas, simplifying complexity, transforming the unfamiliar into the familiar, transforming the abstract into the concrete, and reverse reasoning, thereby enhancing students' problem-solving ability<sup>[9]</sup>.

It can be seen that the occurrence of this phenomenon is inseparable from both teachers and students, and certain activities of both teachers and students can affect students' mathematics grades. However, can teachers be aware of the problems in their own teaching methods? Therefore, the purpose of this article is

to understand the views and corresponding solutions of graduate and undergraduate students majoring in mathematics on this phenomenon through investigation and then conduct analysis. The main questions of this study are:

1. Do current pre-service mathematics teachers recognize that the main reason for the phenomenon of "understanding immediately when hearing but failing immediately when doing" in students' mathematics learning process lies in the problems with teachers' teaching methods?

Do current pre-service mathematics teachers recognize that the solution to the phenomenon of "understanding immediately when hearing but failing immediately when doing" in students' mathematics learning process should start from changing teachers' teaching methods?

### **3. RESEARCH METHODS**

#### **3.1 Sample**

To accurately reflect the degree of cognition of pre-service mathematics teachers regarding the reasons for the phenomenon of "understanding immediately when hearing but failing immediately when doing" among middle school students in mathematics learning, this study selected postgraduate students majoring in Education (Mathematics) and undergraduate students majoring in Mathematics from the School of Mathematics and Statistics of Shandong Normal University as the survey objects. They all have mathematics learning and research experiences, a certain degree of mathematics teaching experiences, and they all have the intention of seeking employment in middle schools in the future. Therefore, relatively effective reference data can be obtained.

#### **3.2 Survey Tools**

This study adopts the interview method for the investigation, which includes a total of three questions: "1. Have you encountered the situation where you can understand in class but have no idea how to do the exercises, that is, 'understanding immediately when hearing but failing immediately when doing'? If so, how many times? 2. What do you think are the causes of this problem? 3. How do you think this problem should be solved?" The reason for choosing these three questions is that they can directly understand the respondents' opinions on the causes and solutions of this phenomenon in students' mathematics learning process. The interview method is adopted because it is highly flexible and authentic, facilitating in-depth research and obtaining the most direct information.

#### **3.3 Data Collection**

To ensure the accuracy of data collection, this study distributed the interview questions in written form to 31 survey objects, collected their written opinions one by one, and finally conducted comprehensive sorting.

#### **3.4 Data Processing**

Firstly, the respondents' answers to the questionnaire were classified and sorted. Then, the respondents' answers were divided and coded, with A and B representing the causes and improvement methods of the phenomenon as perceived by the respondents. Thus, a total of 37 items from A1 to B17 were classified. One by one, the respondents' answers were compared with the coded content. If the meanings were similar, it was considered that the survey object also held this view. If the meanings were different, a new coded number was selected for representation. Finally, the number of people mentioned for each item was counted, the percentage of the respondents who held this view among all the views was calculated, and a statistical table was made.

#### 4. RESULT ANALYSIS

##### 4.1 Degree of Cognition that the Main Cause Lies in the Teachers' Teaching Methods

From the statistical results of the causes in the questionnaire, we can find that among the survey objects, the number of people holding the view that "students did not have a profound understanding" accounted for 64.52% of the total number, which was the largest number of holders, and only the number of holders of this view exceeded half among the coded causes; the number of people holding the view that "students had too little practice" accounted for 41.94% of the total number, ranking second; the number of people holding the view that "students could not apply knowledge" accounted for 25.81% of the total number, ranking third. The number of approvals for other views was relatively small and all less than 20%. The specific data is shown in Table 1.

Table 1: Statistics of Causes

Cause	Percentage of Respondents Holding This View
Students did not have a profound understanding	64.52
Students had too little practice	41.94
Students' problem-solving ideas were limited	9.68
Students were not concentrated in class	6.45
Students could not apply knowledge	25.81
Students confused previous and subsequent knowledge	3.23
Students did not know where their problems were	3.23
Students lacked thinking in class	16.13

Students did not master problem-solving methods and skills	6.45
Students did not review and consolidate knowledge in time	6.45
Students did not form their own knowledge system	9.68
Students' mastery was not solid and proficient	6.45
Students' learning methods were problematic	3.23
Students could not distinguish the examination points of the questions	3.23
Students' learning comprehension ability was poor	3.23
Teachers were too theoretical	9.68
Teachers were not detailed enough	6.45
Teachers' explanations of examples were too single	6.45
Examination questions were too flexible	19.35
Mathematics knowledge itself was difficult	3.23

From the above analysis, we can conclude the following: First, from the perspective of causes, the ratio of the number of causes in the student dimension, the teacher dimension, and the other dimension is 15:3:2. The number of causes in the student dimension far exceeds that in the teacher dimension. Second, among the views held by the respondents, the one with the highest repetition rate, namely, "students did not have a profound understanding", is a cause from the student aspect, and more than half of the respondents hold this view. Third, among the views held by the respondents, the three views with relatively high repetition rates, namely, "students did not have a profound understanding", "students had too little practice", and "students could not apply knowledge", are all causes from the student dimension, and the proportion of the number of people holding these views in the total number exceeds 20%. However, for the teacher dimension, such as "teachers were too theoretical", "teachers were not detailed enough", and "teachers' explanations of examples were too single", they accounted for 9.68%, 6.45%, and 6.45% respectively, and the proportion of the number of people holding these views in the total number is even less than 10%. Fourth, among the respondents, only 25.81% of the pre-service mathematics teachers recognized that the cause might be certain problems in the teachers' teaching methods, that is, only a quarter of them recognized it. Thus, we can conclude that most pre-service teachers believe that the main cause

of this phenomenon lies in the students themselves and have not recognized that the main cause of this phenomenon lies in the teachers. That is, the degree of cognition of pre-service mathematics teachers that the main cause of this phenomenon lies in the teachers' teaching methods is relatively low.

#### 4.2 Degree of Cognition that the Solution Method Should Start from the Teacher's Teaching Method

From the statistical results of the solution methods in the questionnaire, among the survey objects, the number of people holding the view that "students should practice more" accounted for 77.42% of the total number. This view had the largest number of holders and was the only view with more than half of the respondents. The number of people holding the view that "students should summarize and review after class" accounted for 32.26% of the total number, ranking second. The number of people holding the view that "teachers should explain more examples and problem-solving skills" accounted for 25.81% of the total number, ranking third. The number of people holding the view that "students should summarize problem-solving methods and skills" accounted for 22.58% of the total number, ranking fourth. The number of approvals for other views was relatively small and all less than 20%. The specific data is shown in Table 2.

Table 2: Statistics of Solution Methods

Solution Method	Percentage of Respondents Holding This View
Students should preview before class	16.13
Students should understand the proof and discrimination of knowledge	6.45
Students should learn the application and precautions of knowledge	6.45
Students should actively think in class	16.13
Students should summarize and review after class	32.26
Students should practice more	77.42
Students should summarize problem-solving methods and skills	22.58
Students should listen carefully in class	9.68
Students should communicate with teachers more and seek help	3.23
Students should sort out knowledge and form a knowledge system	6.45
Students should carefully analyze the examination points of the questions	9.68

when doing exercises	
Students should do difficult questions to deepen understanding	3.23
Teachers should attach importance to the dominant position of students in the classroom.	16.13
Teachers should adopt a variety of teaching methods.	6.45
Teachers should explain more examples and problem-solving skills.	25.81
Teachers should teach clearly and explicitly.	6.45
Teachers should focus on cultivating students' mathematical thinking.	3.23

From the above analysis, we can draw the following conclusions. First, from the perspective of solution methods, the ratio of the number of methods starting from the student aspect to those starting from the teacher aspect is 12:5. The number of methods starting from the student aspect far exceeds that starting from the teacher aspect. Second, among the views held by the respondents, the one with the highest repetition rate, namely, "students should practice more", is a solution method from the student dimension, and more than half of the respondents hold this view. Third, among the views held by the respondents with relatively high repetition rates, except for the view "teachers should explain more examples and problem-solving skills", which is a solution method from the teacher dimension, the three views "students should practice more", "students should summarize and review after class", and "students should summarize problem-solving methods and skills" are all solution methods from the student dimension, and the proportion of the number of people holding these views in the total number exceeds 20%. However, for the four solution methods from the teacher dimension, except for the view "teachers should explain more examples and problem-solving skills" whose proportion of the number of holders exceeds 20%, the rest are all less than 20%. Fourth, among the respondents, 45.16% of the pre-service mathematics teachers recognized that the existing problems could be improved by changing the teaching methods of teachers, but the number is still less than half. The specific data is shown in Table 2.

Thus, we can conclude that more than half of the pre-service mathematics teachers believe that solving this phenomenon should mainly start from the student aspect, that is, the degree of cognition of pre-service mathematics teachers that the main method to solve this phenomenon should start from the teacher's teaching methods is relatively low.

## 5. DISCUSSION

### 5.1 Cognition Regarding Causes

Based on the above statistical results of causes, we know that the most agreed-upon view by pre-service teachers is "students did not have a profound understanding", with the highest number of approvals accounting for 64.52%. Followed by "students had too little practice" and "students could not apply knowledge", and the number of approvals for the remaining views is all less than 20%. All these reasons are at the student level. From previous studies, we know that the causes of this phenomenon are related to both teachers and students. Most of the surveyed pre-service teachers only recognized the causes at the student level or believed that the main causes were those of the students, while ignoring the causes at the teacher level. Thus, we can conclude that pre-service teachers' understanding of this phenomenon is incomplete and not entirely accurate. Most pre-service teachers are not aware that the main reason why students cannot solve problems independently after class is that teachers did not teach and explain clearly to students in classroom teaching. They almost all believe that the main reason lies with the students themselves. For teachers, if they cannot find the root cause of the problem or identify the wrong cause, the problem will never be smoothly solved and this phenomenon will not be improved. Through the above analysis, it is not difficult to find that current pre-service mathematics teachers have insufficient cognition of the main cause of the phenomenon of "understanding immediately when hearing but failing immediately when doing" being at the teacher level.

### 5.2 Cognition Regarding Solution Methods

From the statistical results of the solution methods in the questionnaire, we can learn that the most agreed-upon view by pre-service teachers is "students should practice more", accounting for 77.42% of the total number. Followed by "students should summarize and review after class", "teachers should explain more examples and problem-solving skills", and "students should summarize problem-solving methods and skills". The number of approvals for other views is relatively small and all less than 20%. From previous studies, we also know that the solution methods should start from both teachers and students, and the solution methods starting from the teacher level are more important. However, most pre-service teachers believe that improvements should start from the students themselves and fewer suggestions for improvement methods at the teacher level were put forward. Thus, we can see that pre-service teachers' understanding of the methods for solving the phenomenon of "understanding but not being able to do" for students is also not comprehensive. Teachers' teaching has a significant impact on students' learning. If only looking for solutions from the student aspect or mainly starting from the student aspect, the problem cannot be smoothly improved. Thus, it can be seen that pre-service mathematics teachers have insufficient cognition of the methods for solving the phenomenon of

"understanding immediately when hearing but failing immediately when doing" starting from the teacher aspect.

## **6. CONCLUSION**

Through our observations of current education and previous studies, it has been found that there is a widespread phenomenon among current students in the process of mathematics learning, namely, "understanding immediately when hearing but failing immediately when doing". So, what is the reason why this phenomenon is widespread but has not been effectively solved? Is it that current mathematics teachers have not recognized that the main cause of this phenomenon lies in the teachers' teaching methods? For this reason, the study selected 31 master's students in education and undergraduates. Through questionnaires, the views of pre-service mathematics teachers on the phenomenon of "understanding immediately when hearing but failing immediately when doing" were investigated. Through investigation and analysis, it was found that current pre-service mathematics teachers generally believe that the main cause of this problem lies with the students, and the solution should start from the students. Thus, it can be seen that pre-service teachers: 1. Have insufficient cognition that the main cause of the phenomenon of "understanding immediately when hearing but failing immediately when doing" lies in the teachers' teaching methods; 2. Have insufficient cognition that the method to solve the phenomenon of "understanding immediately when hearing but failing immediately when doing" should start from the teachers' teaching methods.

Based on the above analysis, it can be seen that pre-service mathematics teachers lack the awareness of teaching reflection. Mathematics teaching reflection has always been an effective means for mathematics teachers to improve their personal professional level. First, through reflection, teachers can deeply analyze their own teaching process, discover the deficiencies and problems, and thereby adjust teaching strategies in a timely manner and improve teaching effectiveness. This process of self-examination and improvement helps teachers continuously enhance their educational and teaching abilities. Secondly, teaching reflection is also conducive to promoting communication and cooperation among teachers. During the reflection process, teachers can share their teaching experiences, confusions and insights. This kind of communication and cooperation helps to form a joint force in education and teaching, and also promotes the improvement of the quality of education and teaching.

Based on the above conclusions, the following suggestions are proposed: Firstly, improve the awareness and ability of teaching reflection of pre-service mathematics teachers through training. Secondly, pre-service mathematics teachers should recognize that: 1. The teaching method where the teacher "performs" alone is ineffective; 2. The teaching method where students are asked

to "memorize" is ineffective. Finally, pre-service mathematics teachers should do the following: 1. Clarify the steps of classroom teaching. For the teaching of problem-solving methods and knowledge, conduct "hand-in-hand" teaching. The teacher demonstrates first, then lets students practice, and finally increases the difficulty and speed for variant training; 2. Whether it is teaching or practice, it is necessary to follow the cognitive development law of students, proceeding from easy to difficult and step by step; 3. Deeply study and research various and effective teaching methods to enrich the theoretical and practical knowledge of teaching methods.

The research objects of this survey were 31 master's students in education and undergraduates. The sample size was small and concentrated in the same institution. Other types of pre-service junior high school mathematics teacher groups were not involved, and the sample selection range was narrow. Therefore, in the future, it is necessary to expand the scope of the research sample, conduct more comprehensive investigations and analyses, and adopt multiple research methods to obtain a more comprehensive and detailed understanding of the current pre-service mathematics teachers' cognition of the main cause of this phenomenon, which is the incorrect teaching methods of teachers and the solution should start from the teachers.

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