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Features of Student Engagement in Chinese Middle School Mathematics Classrooms

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This study focuses on student engagement in Chinese middle school mathematics classrooms. By the recording and quantitative analysis on video case, this study explored the main acts and time of student engagement. The data showed that among the student engagements:
(1) Students' responses to teacher's question occurred most frequently;
(2) Collective responses were much more than the individual responses;
(3) Students' responses and classroom practice spent the longest time;
(4) The most frequent student engagements occurred in the aspects of classroom practice; and
(5) Students rarely asked a question to teachers.
The study also suggested that teacher's effective guidance could improve the level of student engagement and the content of classroom practice is very important to the quality of student engagement.

Keywords: student engagement, classroom practice
MESC Classification: C23, C70
MSC2010 Classification: 97C70, 97D50

1. INTRODUCTION

With the deepening of the curriculum reform, student engagement and its impact on students' achievement have become an important theoretical and practical significance of

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the subject in the mathematics education research. On the one hand, the constructivists advocated that learning is a process of active construction rather than a passion of construction. Actually, when students are asking questions, making a statement or collaborating with classmates is the process of active construction in the classroom, and the level of student engagement decides the quality of knowledge to be constructed and the quality of mathematics classroom teaching. On the other hand, the teaching and learning have inherent connection of dialectical unity. Student engagement in the classroom is a reflection of student's subjectivity as well as is meaningful to teaching. In order to enable that more effective teaching and learning activities are carried out, teacher can use student's response, question or statement to grasp student's situation betimes, and so as to pace his/her teaching to that.

The research on student engagement will help students to develop the sense of student engagement, correct mistakes in mathematics learning, guide the method of student engagement, improve the ability of student engagement, acquire the mathematical knowledge (Kong, 2003; Kong, Wong & Lam, 2003; 2004). And the research was concerned essentially on the behavior engagement, emotion engagement, and cognition engagement of student. However, there is still a significant difference in the definition of student engagement to the researchers. They regard the student engagement as behavior engagement, emotion engagement and cognition engagement by their own study view.

Moreover, although the classroom teaching has been focused on the reform, the research on student engagement mainly concentrated in the western countries argued that with the expansion of education and the development of universal education, the more resources which from national and personal are input to education, the less passion of student engagement in the classroom, student disengagement is one of the most direct and sustained the reasons about that (Newmann, 1992). The measuring tool of that is some kind of questionnaire, just like the questionnaire to student engagement (Marks, 1998; 2000), the questionnaire to student's emotional engagement (Miserandino, 1999), but the question in the questionnaire is simple ,and the questionnaire is still in its infancy..

Student engagement is mainly researched in the west while rarely in China, however, some Chinese researchers are breaking the ice. Kong (2003) has argued the student engagement consists of behavior engagement, emotion engagement and cognition engagement. He used questionnaires to measure the relationship between situation of student engagement and student's achievement. Yet, to date, little research focused on the features of student engagement in Chinese middle school mathematics classrooms by quantitative analyze. This article focuses on middle school students' engagement in mathematics classrooms by use the recording and quantitative analysis on video case that seeks to explore the main acts and time of student engagement, and give the suggestion for the teacher to improve the quality of student engagement.

2. THE STUDENT ENGAGEMENT IN THE MATHEMATICS CLASSROOM

The researchers regard the student engagement as behavior engagement, emotion engagement and cognition engagement by their own study view. Kong (2003) considered the student engagement that consists of behavior engagement, emotion engagement, and cognition engagement. We also believe that the student engagement in the classroom includes behavioral and cognitive engagement as well as emotional engagement, and, in the one hand, the student's behavioral engagement could reflect the cognitive and emotional engagement, in the other hand, the cognitive and emotional engagement could be demonstrated through the student's behavioral engagement in the classroom.

Generally, the students' cognitive and emotional engagements were analyzed by the questionnaire survey and interview, and it is not easy to quantify that. However, the student's behavioral engagement can be recorded analysis through the video case and we can also quantify that. Consequently, our research on student engagement is mainly directed against the behavioral engagement.

3. METHOD

3.1. Participants

Participants were almost 180 middle-school (6th and 7th grade, each grade has two chasses and each class has almost 45 students) students. The participants' overall level standing in the middle ranks of the school, and the teachers are young who have 2 or 3 years teaching experience. The contents of classes are the multiplication and division of fraction (the first half of the 7th grade) and the fundamental nature of inequality (the second half of the 8th grade). The school was selected as the site for this research based upon the long-term cooperation between us and the teachers would be interested in participating.

3.2. Procedure

The results presented in this paper are mostly based on the recording and quantitative analysis on video case. Video is an important and flexible instrument for collecting aural and visual information.

The framework of research is observing–videotaping–recording–coding–analyzing–feedbacking–improving. The specific analytical methods are as follows:

1. Observe in the classroom teaching and at the same time videotaped the lesson,

after the class, we caught on the teachers and students' background by interviewing the teachers and students.
2. Record the whole lessons which include teachers and students' all kind of languages and behaviors, and also recorded the time.
3. Classify the acts of student engagement in each lesson.
4. Collect statistics and analyze the student engagement.
5. Summarize the effective and ineffective student engagement.

4. CODING

In this section we provide details regarding the coding of each classification.

4.1. Coding students' engagement in the mathematics classroom

According to students' proactive behavior and student responses to teacher's behavior, student engagements were coded as response, ask question, reading, cooperative learning, thinking, practice with blackboard, practice without blackboard, discussing, raising hands, other.

4.2. Coding the student's response in the mathematics classroom

According to the complexity of student's response students' responses were coded as no answer, mechanical, memorized, comprehensive, creative. A response was coded as no answer if the student did not answer the teacher's question; as mechanical if the student's answer was the teacher or other students had been given; as memorized if the student could answer the question through the memories of the knowledge; as comprehensive if the student answer the question through thinking and understanding; as creative if the student could use the existing knowledge to create some new ideas.

4.3. Coding the section of teaching in the mathematics classroom

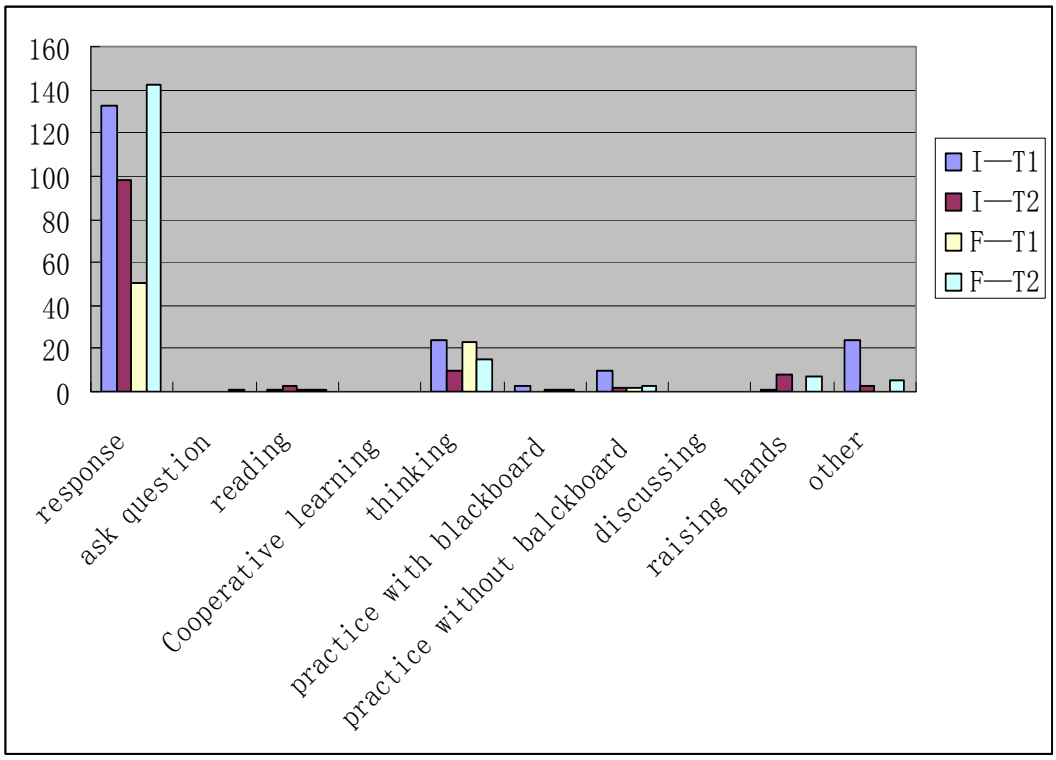
According to the content of teaching, the sections of teaching were coded as preparing, introducing, construing, practicing, summarizing. A section was coded as preparing if the section of teaching was used to prepare for teaching; as introducing if the section of teaching was used to introduce the new knowledge; as construing if the section of teaching was used to explain the new knowledge; as practicing if the section of teaching was used to do the exercise; as summarizing if the section of teaching was used to sum up the lesson.

5. RESULTS

We focused first on students' performance and its time of each lesson, then, turned to the student's response to teacher's question and the student engagement in each section of teaching. The major features of student engagement in mathematics classroom were as follows:

5.1. Student engagement

5.1.1. Student's response is the most frequent among the behaviors of student engagement



Note: I: The fundamental nature of inequality
F: The multiplication and division of Fraction
T1: The first teacher
T2: The second teacher

Figure 1. The frequency of student engagement occurred

Figure 1 display the situation of student engagement in the four lessons, student's response to the teacher's question is the most frequent behavior, and far more than the

other behaviors. While there are so many student's responses, the number of ask question is rare or never. In addition to student's response, the number of thinking is occurred most frequently, and we can see the practice in every lesson although it's a low frequency.

5.1.2 Student's response takes the longest time among the behaviors of student engagement, followed by practice with blackboard and practice without blackboard

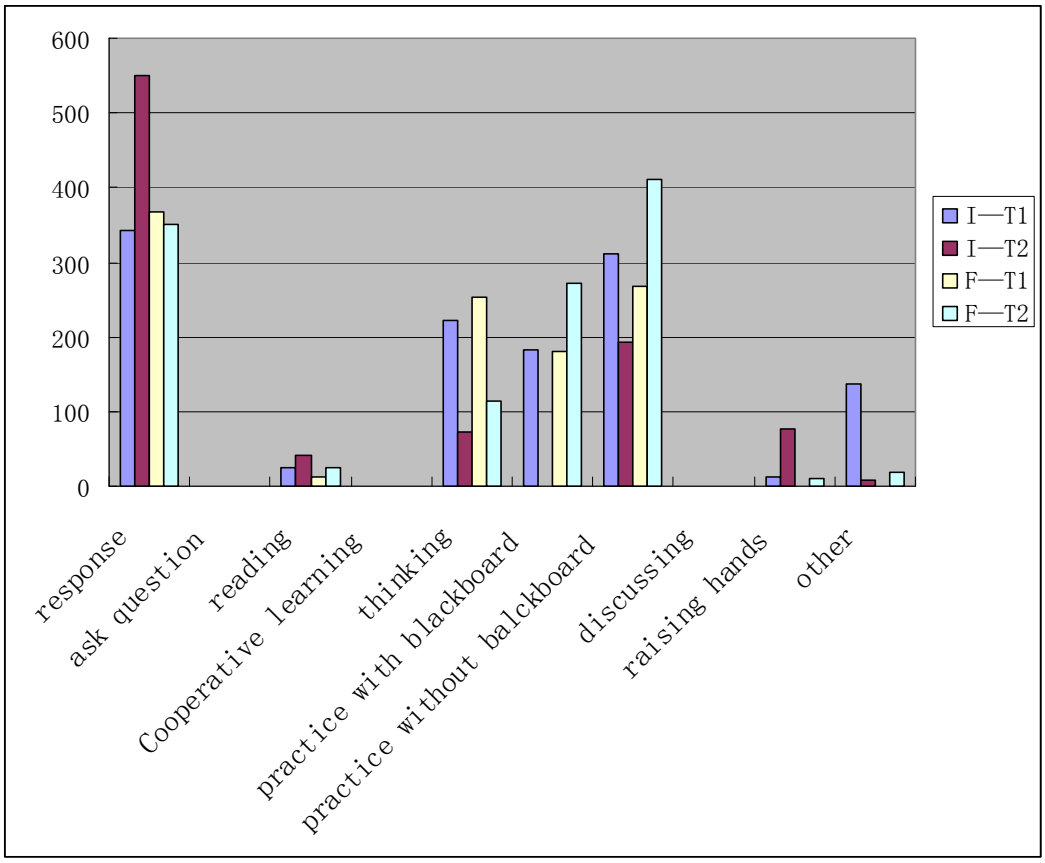


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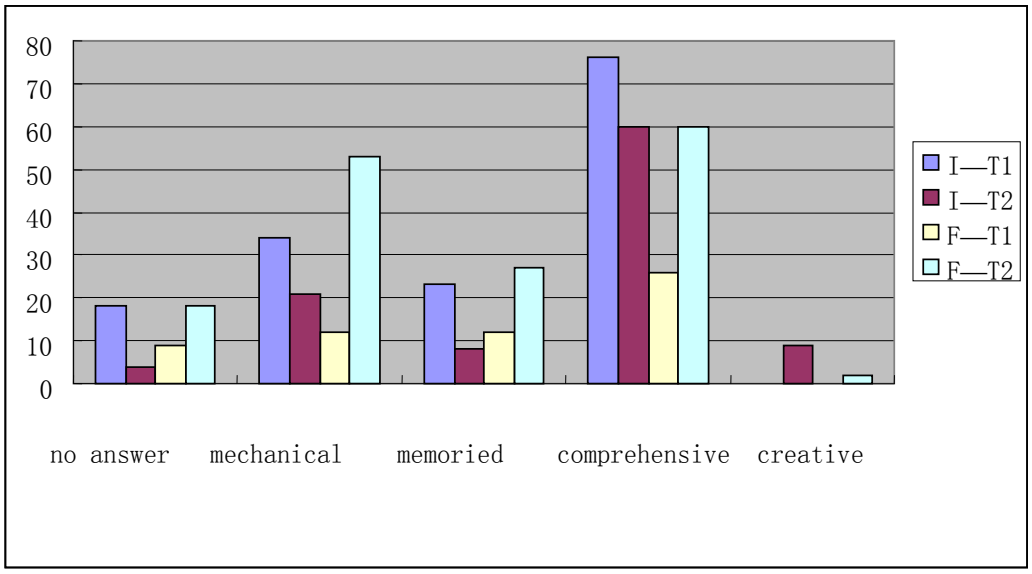
Figure 2. The time (Unit: seconds) of all kinds of student engagement

As seen in Figure 2, student's response takes the longest time among the behaviors of student engagement, followed by practice with blackboard and practice without blackboard. When we classify the student engagement, classroom exercise was divide

into practice with blackboard and practice without blackboard, therefore, the overall time of classroom practice is more than student's response. Addition, the thinking spent some time, and the reading as strengthen the students' attention and memory was also taking up part of time.

5.2 Student's response

5.2.1 The comprehensive response occurred most frequently among the students' responses, followed by the mechanical response



Note: I: The fundamental nature of inequality
F: The multiplication and division of fraction
T1: The first teacher
T2: The second teacher

Figure 3. The frequency of all kinds of students' responses

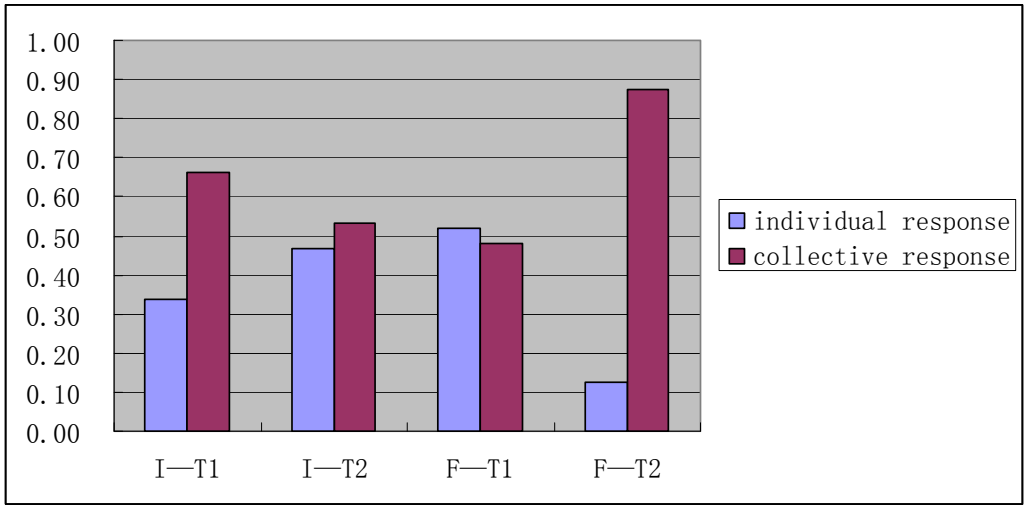
In statistics, we found that students' response occurred most frequently, moreover, response could train the student's language skills as well as help teacher to understand the situation of student knowledge better. So we conducted the further analysis of students' response.

As seen in Figure 3, the comprehensive response occurred most frequently among the students' responses, this kind of response could reflect the extent of comprehension of knowledge, furthermore, the process of thinking and understanding could promote the construction of student's knowledge. Yet, that the response occurred in the classroom that we saw least was creative response—the ultimate in the responses. It worth noting that

the number of times of the mechanical response just followed by the comprehensive response. That can promote fluency in basic facts to student, but isn't very effective.

5.2.2 Collective responses were more than the individual responses

As seen in Figure 4, the collective response occurred more often than the individual response. In order to active classroom atmosphere, the teacher need to use the collective sometimes, but some students answer the question weren't serious in the collective response. The student who answer the question individual would more involved



Note: I: The fundamental nature of inequality
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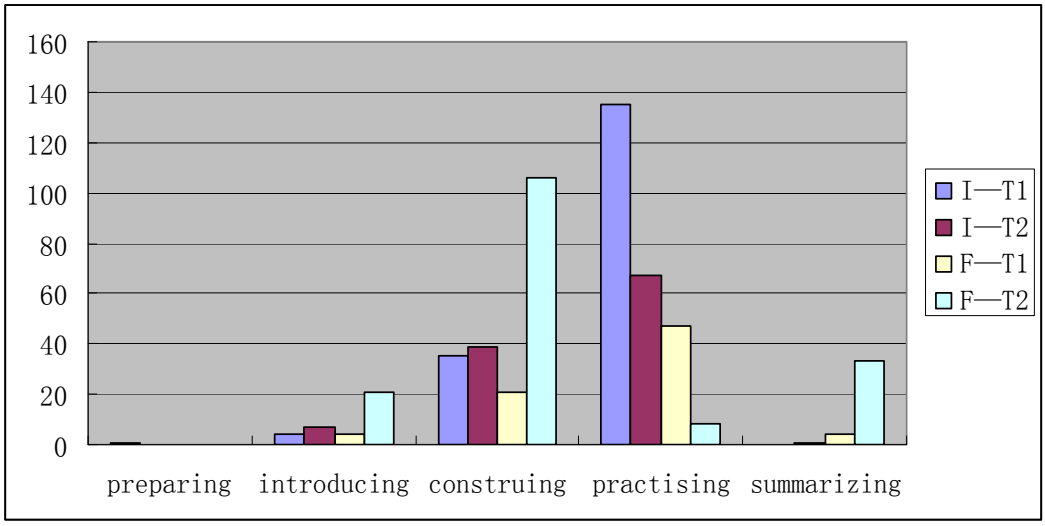
Figure 4. Proportion of individual and collective response in each lesson

5.3. Student engagement in the each section of teaching

5.3.1 Student engagement is the most frequent in the section of practicing, followed by the section of construing

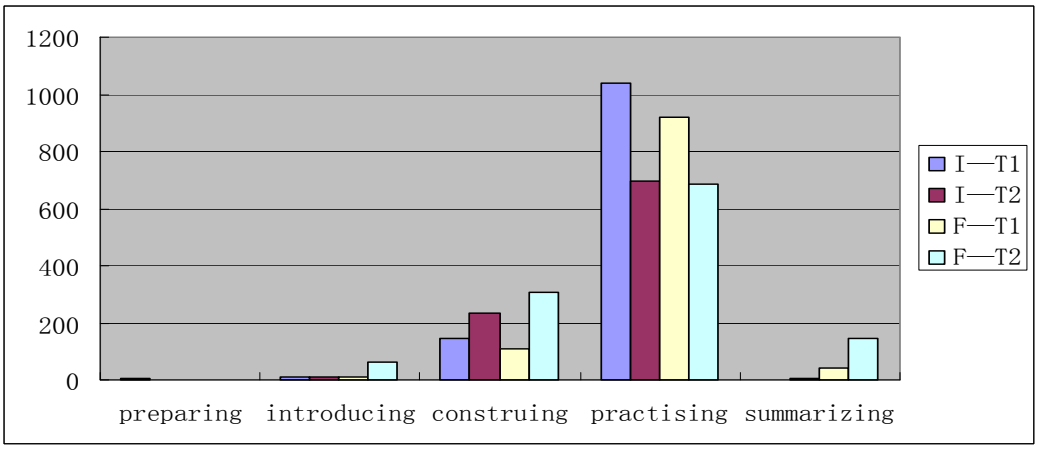
In order to analyze the student engagement better, we divided the whole into five parts, as seen in Figure 5; the student engagement is the most frequent in the section of practicing, the section of construing just followed by. In the section of practicing, all students participated in the exercise and the level of student engagement was high when the teacher was checking the answer. It should be noted, though, the present educational reform advocates the students to summarize by themselves in the lesson, this has not been

the case as seen in Figure 5, the student engagement in the section of summarizing occurred much less frequently.



Note: I: The fundamental nature of inequality
F: The multiplication and division of fraction
T1: The first teacher
T2: The second teacher

Figure 5. The time (Unit: seconds) of student engagement in each section of teaching



Note: I: The fundamental nature of inequality
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Figure 6. The time (Unit: seconds) of student engagement in each section of teaching

5.3.2 Student engagement takes up the longest time in the section of practising, the section of construing just followed by

Lastly, as seen in Figure 6, student engagement takes up the longest time in the section of practicing, which certainly indicated that the teacher gave students sufficient time to do the exercise in the classroom. And the section of construing just followed by. In the other section the time is relatively short.

6. CONCLUSION

Student engagement in the mathematics classroom form the basic Classroom learning, but the proportion of time in the each section classroom teaching is different. The student engagement accounts for a significant proportion in the classroom teaching. The teacher asked the question, then the student choose the best answer to each question, and that constitute the whole classroom teaching. Most students participate in the section of construing and practicing, a handful of students participate in the section of introducing and summarizing.

At the same time, we also discovered that, in the classroom teaching, the student mainly participate in the classroom teaching. Through practice and answering questions, therefore, the choice of the exercise and question are sometimes very important to lead student to participate in the classroom teaching. Furthermore, the behavior and time of participation in the classroom teaching is different from different class, simultaneously, the same content of class and the different teacher, the behavior and the time are also different. Unifying the above statistics and the analysis, in order to improve the efficiency of the behavior of participation in the classroom, we believe that it can be helpful to think about it from following perspectives.

6.1. Strengthen the teacher's effective guidance, and then promote the student effective to participation

The statistical data shows that the Student response, which is a direct consequence of Teacher's questions, is primary participative behavior in the classroom, therefore, the quality of the Teacher's questions directly affect the quality of the student response and student's participation condition. We also find that the Understanding of response and the Mechanical response are most in the massive response by the analysis of student's responses. Although, in order to enliven the classroom atmosphere, sometimes teacher needs to improve student attention through simple inquiry and let the student carry on mechanical response, yet mechanical response is basically inefficient or ineffective for

the promotion of students' solving problem and the enhancing the understanding of knowledge. The understanding response is the process of the thinking on and understanding the question, which is helpful for the student to solve the question and construct the knowledge. So the teacher must reduce as far as possible the number of the Ineffective questions, increase the questions which can promote the student to solve the problem and understand the knowledge, and then guide the student to carry on the effective response.

Meanwhile, in statistics, we also discovered that most of the students' response was a collective response, only a small fraction of response is individual response, that the chance for the student to participate in the classroom is not many. In the collective response, the phenomena of lazy students and hopeless ones are quite common, even if some students did not know how to reply the question, they also can reply carelessly with other schoolmates. Consequently, in the appropriate scope, the teacher should give much opportunity for student to develop the individuality and autonomous participation, so that the student can build the structure of the knowledge in the inquiry learning and reduce the collective response.

6.2. Reasonable alternative the content of classroom practice and ensure the effectiveness of student engagement

The classroom practice is also the primary participative behavior in the student classroom. The content of classroom practice and the practice process directly affect the quality of the Participation in classroom practice. For that reason, selecting the content of the practice and optimizing the process of practice will definitely play a very important part in the consolidation of what student learned in the classroom and the training of arithmetic capability. Meanwhile, it also can make the teacher to capture feedback from the student for a short while, timely evaluate the student in the process of the student practice, and do a summary evaluation when the practice is over, so that they can help students to fill a vacancy leak and promote understand and master more profoundly the intension of knowledge.

6.3. Create a democratic classroom environment and encourage students to ask the question

From the above statistical analysis, we can find that the student asked fewer questions in the classroom, teachers controlled the rhythm of the classroom, so that the student was passive and passively followed the teacher. Asking the questions as an effective classroom participative behavior is representation of the student who actively constructs the knowledge. How can we improve the behavior that the student asks questions in the

classroom, and make the student positively participate in the classroom teaching?

First, the teacher must create democratic classroom environment and establish a little psychological weight learning atmosphere for student. It is essential to improve autonomous participation.

The next, we should inspire the student's self-confidence of study mathematics and encourage the student to ask the question, because the student's self-confidence of study mathematics maybe the reason for the student who insufficiently ask in the classroom. The Trend of International Mathematics and Science Study (TIMSS, 2009) found that, five countries and regions of the East Asian area which are affected by the Confucians: Singapore, Hong Kong, the Chinese Taipei, Japan, and South Korea, the test scores are in front in all successive TIMSS tests, but after the self-confidence investigation, we found that these national student self-confident is lower than the international average level. China as the birthplace of Confucian culture, the student self-confidence cannot be high. As a result, even if the students have some question on certain knowledge point, certain problem and view the issue in a different light, they cannot ask the question in the classroom.

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