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Empirical research on senior high school mathematics teachers' understanding of the students' learning situation after class

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Abstract
This research investigated the current status that the senior high school mathematics teachers' understanding of the students' learning situation after class. A total of 72 senior high school mathematics teachers from four cities in Shandong province participated in this investigation. This research adopted the method of interview and open-ended structure questionnaire to collect information. The results showed that: (1) 69.4% of the senior high school mathematics teachers chose less than 6 students to understand their learning situation; (2) 44.4% of the senior high school mathematics teachers focused on understanding the situation of the middle students' learning; (3) 66.7% of the senior high school mathematics teachers tended to understand the students' learning situation just after new class; (4) 44.4% of the senior high school mathematics teachers usually took about five minutes to understand the situation of students' learning; (5)80.6% of the senior high school mathematics teachers usually understood students' learning situation though direct requesting and 65.3% of them understood students' learning situation by looking through their homework and exercise; (6)55.6% of the senior high school mathematics teachers were inclined to understand the contents of the mastery of knowledge. Therefore, the current senior high school mathematics teachers' after-class understanding of students' learning situation was obviously unreasonable and not deep enough, which may be one of the reasons why current senior high school mathematics teachers couldn't conduct effective teaching smoothly.

Keywords: Mathematics Learning; Understanding of the Students' Learning Situation; After Class; Senior High School

1. Introduction

Teaching based on development of students is a core concept of modern mathematics education reform (Cai, B.X., 2013; Wu, Q.H., 2004)[1, 6], yet that needs to fully understand the basic situation of students' learning first, understanding the students' learning situation accurately is the cornerstone of student-centered teaching for teachers (Ma, R.F., 2007) [5]. Therefore, the question regarding how to understand the students' learning situation has been paid high attention to at present and the research in this area has increased every year. However by reviewing these studies, it can be easily found they all almost explore the strategies and application methods of understanding students' learning situation (Chen, R.F., 2009; Deng, J.P., 2014; Gao, P., 1990) [2-4], few studies are about the current actual situation. How the teachers understand the learning situation of students at present? Do they understand it comprehensively and deeply? It is still unknown. Indeed, it is very, important to find that how the current mathematics teachers understand the situation of students' learning. Only by recognizing the above fact, can we propose some specific ways to help teachers to further improve the level and ability about how to understand the situation of students' learning, and promote student-centered teaching performed thoroughly. To this end, we chose a part of high school mathematics teachers of Shandong Province, and conducted a investigation study. The timing when high school mathematics teachers understand students' learning situation Can be before class or after class. This study focused on investigating how the current senior high school teachers understand the situation of students' learning after class.

2. Methodology

2.1 Participants

We selected randomly a total of 72 high school mathematics teachers as respondents from Weifang city, Qingdao city, Zibo city and Dezhou city. These 72 people consist of 29 male teachers and 43 female teachers, and in these 72 people, 21 young teachers are younger than 35 years, 32 middle-aged teachers are between 35 and 50 years, 19 teachers are older than 50 years.

2.2 Instrument

Through reviewing of relevant literature, analyzing domestic and foreign researchers' studies about how mathematics teachers understand students' learning situation after-class, and considering the current status of the teachers' understand of the students' learning, we formulated an interview outline. On the basis of reference to relevant information and the preliminary interviews, we adopted an open-ended structure questionnaire. Our questionnaire mainly related to the mathematics teachers' understanding of the situation of students' learning after-class, contained six areas about students' number and types, the timing, duration, manner and contents of understanding.

2.3 Data Collection
This investigation adopted the combination of interviews and questionnaires, recorded the respondents' answer first, and organized them into text materials afterward.

2.4 Data Analysis
We encoded the recording materials with qualitative analysis software Nvivo10 at first, and then analyzed the codes in table and calculated the frequencies and percentage of each code. All results were obtained from these percentages.

3. Results
During the investigation, all teachers who participated in the investigation have expressed that understanding students' learning situation after class is necessary, and the vast majority of teachers often understand students' learning after-class.

3.1 The Number of Students
Regarding the number of students to be understood, as shown in Table 1, many teachers (69.4%)chose less than 6 students, some of the teachers (11.1%) selected 7-12 students to understand, small proportion of teachers selected 13-16 people (6.9 %), only a little part of teachers(5.6%) would choose more than 17 students to understand their learning situation. So it can be seen that the number of students who were selected by teachers to understand after class is generally small, usually less than six people.

Table 1: The number of students

Number	Teachers(percentage)
Less 6 students	69.4
7—12 students	11.1
13—16 students	6.9
More than17 students	5.6

3.2 The Type of Students
As shown in Table 2, in the investigation that whether the teacher would treat students hierarchically when they understand students' learning situation, most teachers (63.9%) might divide students into different levels to understand, there were also some teachers (36.1%) who did not stratified the students in the process of understanding. Among the teachers who understand students' learning situation hierarchically after-class, nearly half (44.4%) focused on the middle students, some (27.8%) would pay attention to understand students with learning difficulties, only a small number of teachers (15.3%) cared about understanding the outstanding students. Thus the outstanding students seemed not to be concerned enough.

Table 2: The type of students

Stratification	Teachers (percentage)	Type	Teachers (percentage)
Stratify	63.9	Outstanding students	15.3
Not stratify	36.1	Middle students	44.4
		Backward students	27.8

3.3 The Timing of Understanding
In terms of the timing of understanding students' learning situation, it could be seen from Table 3, more than half of the teachers (66.7%) selected to understand students' learning situation just after new class, about one third teachers (34.7%) chose in self-study courses, some teachers (12.5%) would understand the situation of students' learning after the feedback of their homework. Most teachers tended to choose this simple way that understand the students' learning situation at recess.

Table 3: The timing of understanding

Timing	Teachers (percentage)
Just after new class	66.7
Homework feedback	12.5
Self-study courses	34.7

3.4 The Duration of Understanding
In terms of the duration of understanding students' learning situation, it could be found in Table 4, nearly half of the teachers (44.4%) understood students' learning situation in five minutes or so, some teachers (19.4%) used about 10 minutes to understand, a small proportion of teachers (8.3%) took about 20 minutes to understand, minority of teachers' (4.2%)understanding lasted for about 30 minutes, only 1.4% of teachers adopted long time, 30 minutes or more, to understand students' learning situation. In a word, the time that teachers took to understand students' learning was generally short.

Table 4: The duration of understanding

Duration	Teachers (percentage)
About 5 minutes	44.4
About 10 minutes	19.4
About 20 minutes	8.3
About 30 minutes	4.2
More than 30 minutes	1.4

3.5 The Ways of Understanding
Regarding the ways of understanding students' learning situation, the investigation results showed that the teachers usually chose both direct and indirect manner to find out the learning situations after-class. As shown in Table 5, most teachers used these two ways to understand, but the proportion of indirect manner was slightly higher than direct. About the direct understanding, teachers usually adopted the way of asking questions, the questions asked were mainly related to the mastery of the basic knowledge (25%), comprehension and flexible use of knowledge (22.2%) and the confusions that existed in the study (29.2%), only a few teachers' questions (4.2%) were related to the students' interest in learning. So, high school mathematics teachers paid more attention to students' mastery of knowledge rather than students' interests in learning.

In terms of the way of indirect understanding, the majority of teachers (65.3%) understood students' learning situation though exercise or homework, a small proportion of teachers, only 8.3%, understood the situation of students' learning

through quizzes and analyzing the reaction in classroom, a few teachers (4.2%) also used other ways to understand, for example, through questionnaires, viewing students' class notes or asking other teacher and students' parents etc. It can be seen that most teachers' ways of understanding students' learning situation indirectly are relatively simple.

Table 5: The ways of understanding

Direct inquiry	Teachers (percentage)	Indirect	Teachers (percentage)
Basics	25	Homework or exercise	65.3
Comprehension and Application	22.2	Quizzes	8.3
Puzzle	29.2	Reaction	8.3
Interest in learning	4.2	Others	4.2
Total	80.6	Total	86.1

3.6 The Contents of Understanding

Regarding the contents of understanding, it could be seen from Table 6, more than half of the teachers (55.6%) focused on students' mastery of knowledge, nearly one third of teachers (26.4%) mainly understood students' confusions in class, some teachers paid attention to understand students' application of knowledge, some teachers focused on students' confusions that existed in homework and exercises as well as their ways to solve them, accounted for 16.7% and 13.9% respectively, at the same time, some teachers (23.6%) cared about students' learning attitude while they understood their learning situation, only a few teachers (9.7%) noticed students' suggestions for teaching and whether they have adapted teaching methods. In conclusion, it might be said that teachers tended to understand the students' mastery of knowledge, and attached importance to students' puzzles in class and learning attitude, but the confusions that existed in homework and exercises as well as students' adaptation to teaching method were paid less attention to.

Table 6: The contents of understanding

Contents	Teachers (percentage)
Mastery of knowledge	55.6
Confusions in class	26.4
Application of knowledge	16.7
Puzzles and solution in homework and exercises	13.9
Learning attitude	23.6
Teaching methods	9.7

4. Discussion

From the above analysis of the investigation results, it could be found that when the senior high school mathematics teachers understand the students' learning situation after-class, there exist some main features as follows:

1. The ways that teachers chose to understand the situation of students' learning were not reasonable enough. Based on the results above, high school mathematics teachers understood the situation of students' learning after-class mostly through direct inquiry, or homework and practice. Both methods were relatively simple. Moreover, the timings that teachers chose to understand students' learning situation were generally just after new class, always in haste, so it was frequently difficult to obtain the real results.
2. The teachers' understanding of the students' learning situation at present lacked comprehensiveness. As can be seen from Table 1, most teachers chose six or less students to understand, thus vast majority of students were not understood. As for the levels of students to be understood, they mainly focused on middle students and backward students, lacked the attention to outstanding students, which resulted that we can't take care of the development of all students. In addition, the content that was understood by teachers was relatively single. More than half of the teachers were interested in students' mastery of knowledge, and had some concerns about the students' puzzles and learning attitude, but the comprehension and application of knowledge, the way to solve puzzles, and the students' attitude to teaching methods didn't paid enough attention to.
3. The teachers' understanding of the students' learning situation was not deep enough. From the investigation related to the duration of understanding, it could be seen that nearly half of the teachers used about five minutes to understand students' learning situation, so that it was usually difficult to understand the true situation of students.

5. Conclusions and Suggestions

Although the number of people involved in research investigations was not so many, just 72 indeed. And the number of questions in this investigation was also not large, only six questions actually. However, the research didn't lose generality. The 72 high school mathematics teachers were all from general areas and schools, and they are in the different genders and different ages. The questions not only involved methodology and contents but also related to the timing and duration. Based on the results above and the analysis, we put forward the following advice:

1) To strengthen the learning of theoretical knowledge. Through the previous investigation, we found that many teachers were not sure what contents they should understand after-class, and what ways they can use to communicate with students. We recommend that senior high school teachers should learn the theoretical knowledge about how to understand students' learning situation after-class actively and make sure the content and degree of understanding; at the same time the high school mathematics teachers had better strengthen the knowledge about the psychology, which can promote teachers to understand students' learning in-depth and scientifically.
2) To care about the development of non-intelligence factors of students. During the investigation, we found that teachers prefer to understand students' intelligence factor, for example whether they can understand or utilize the knowledge; however, the development of students should be more comprehensive. Thus we recommend that when

teachers understand the students' learning situation, they should pay more attention to understanding the emotion, will, attention and other aspects of students, care about the development of non-intelligence factors.

3) Try to focus on the comprehensive growth of all students. Based on the research above, we discovered that the number and types of students that were understood by teachers were limited, and the duration of understanding was short. Too few students were understood so that the teachers failed to take care of the majority of students' learning situation; the short duration also made the understanding of learning situation not deep enough. Based on this phenomenon, we suggest that senior high school teachers should try to select more students to understand after class, especially, they should pay more attention to understanding and guiding outstanding students, so that each student could experience more comprehensive development. Additionally, senior high school teachers should choose a variety of timings to know the students, understand in-depth as much as possible, so as to obtain the real situation, only in this way can we guide students more effectively.

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