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Empirical research on senior high school mathematics teachers' tutoring in extra-curricular time

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Abstract
This research focused on the current status of senior high school mathematics teachers' tutoring in extra-curricular time and adopted face-to-face interview way to collect data. A total of 34 mathematics teachers from 6 senior high schools in Shandong Province participated in this investigation. The results indicated: (1) 96.67% of teachers usually tutored outstanding students; (2) 93.33% of teachers always adopted the one-to-one form to tutor; (3) 89.33% of teachers tutored students in free class ; (4)89.02% of teachers tutored students not more than 10 minutes; (5) 90.21% of teachers generally tutored students knowledge about problem solving, etc. So the current ways of senior high school mathematics teachers' tutoring was obviously too simple and superficial. This should be the direct reason resulted in the poor effect of mathematics tutoring in extra-curricular time in current senior high school.

Keywords: Mathematics Tutoring, Mathematics Teachers, Extra-Curricular Time, Senior High School, Tutoring Effect

1. Introduction
The mathematics tutoring in extra-curricular time is an assistant or auxiliary mathematics teaching after class based on the mathematics teaching in classroom. The aims of the mathematics tutoring in extra-curricular time are to help students understand the mathematics knowledge well or improve their ability of mathematics application, in order to make the mathematics teaching reach the teaching objectives completely and make each student develop fully. Hence the mathematics tutoring in extra-curricular time is a very important link of mathematics daily teaching and had caused many mathematics teachers to pay attention to it (Bai, H.L. & Liu, J.Q., 2005; Gui, T., 2014; He, F. 2013; Jiang, Zh. F., 2009; Sun, L., 2010) [1, 2, 3, 4, 5]. However according to our actual observation about the mathematics tutoring in several senior high schools, the effects of mathematics teachers' tutoring were generally not ideal, some effects were even extremely poor. How did the present senior high school teachers tutor students? Why did they not achieve good effect? To find out its reason, we conducted an investigation in six senior high schools.

2. Method
2.1 Participants
We chose 34 mathematics teachers randomly as objects of investigation in six senior high schools in Shandong province. These 34 mathematics teachers consisted of 20 female mathematics teachers and 14 male mathematics teachers, and in which there were 11 young teachers less than 35 years old, 14 middle aged mathematics teachers between 35 and 50, and 9 older mathematics teachers aged over 50 years old.

2.2 Instruments
We adopted an open-ended structure self-developed questionnaire based on relevant literatures. This questionnaire involved mainly the forms, students, time, duration, contents, process and the requirements of tutoring.

2.3 Data Collection
To obtain the detailed and full data, we interviewed every chosen teacher by face-to-face, recorded what they said firstly, and organized their recording into text materials afterward.

2.4 Data Analysis
We encoded the obtained text materials with qualitative analysis software nvivo10 at first, and then analyzed the codes in table and calculated the percentages of each code.

3. Results
3.1 Tutoring Forms
As for the tutoring forms, some senior high school mathematics teachers got used to adopting the form of one to one, while others got used to tutoring students more than one at same time, and also a part of senior high school mathematics teachers did not have fixed forms. The details of senior high school mathematics teachers' tutoring forms were as shown in table 1. From the table1, we could know that about 93.33% of senior high school mathematics teachers got used to adopting the form of one to one.

Table 1: the forms of teachers' tutoring

Tutoring ways	Teachers(percentage)
One-to-one	93.33
More than one students	42.34

3.2 The Students Tutored by Teachers
Regarding the students who were tutored by teachers usually, 96.67% of senior high school mathematics teachers said they usually tutored the outstanding students, 73.33% of senior high school mathematics teachers usually tutored middle level students, only about 16.68% of senior high school mathematics teachers usually tutored the backward students also. The details were as shown in table 2.

Table 2: the students tutored by teachers

Students	Teachers(percentage)
Outstanding students	96.67
Middle level students	73.33
Backward students	16.67

3.3 The Tutoring Time

As for the tutoring time, according to the answers of senior high school mathematics teachers, some of senior high school mathematics teachers got used to tutoring students between classes, some of senior high school mathematics teachers got used to tutoring students in free class time, and some of senior high school mathematics teachers got used to tutoring students after class. The specific situation was as shown in table 3. From table 3, we could knew that 89.33% of senior high school mathematics teachers usually tutored students in free class time, and 73.26% of senior high school mathematics teachers usually tutored students between classes, and 24.38% of senior high school mathematics teachers got used to tutoring students in lunch time or after school.

Table 3: the time of tutoring students

Tutoring time	Teachers(percentage)
Between classes	73.26
After classes	36.67
In free class time	89.33
In lunch time or after school	24.38

3.4 The Duration of Teachers' Tutoring

According to the answers of senior high school mathematics teachers who participated in this investigation, we knew most senior high school mathematics teachers tutored students not more than 10 minutes, only a few of senior high school mathematics teachers tutored students more than half an hour. The details of duration of senior high school mathematics teachers' tutoring were as shown in table 4. Form table 4, it could be seen that 56.82% of senior high school mathematics teachers usually tutored students in 5 minutes, 32.22% of senior high school mathematics teachers usually tutored students about 10 minutes, only 3.71% of senior high school mathematics teachers usually tutored students over half an hour.

Table 4: the duration of teachers' tutoring

duration	About 5 minutes	About 10 minutes	15 minutes to 30 minutes	More than 30 minutes
Teachers (percentage)	56.82	32.22	7.25	3.71

3.5 The Contents of Teachers' Tutoring

As for the contents of teachers' tutoring, according to the answers of senior high school mathematics teachers, we knew the most of them was about problem solving, very few were others. The details about content which senior high school mathematics teachers usually tutored for students were as shown in table 5. From table 5, it could be seen that 90.21% of senior high school mathematics teachers usually tutored students' knowledge about problem solving, 23.46% of senior high school mathematics teachers usually tutored students the basic mathematics knowledge, only 21.34% of senior high school mathematics teachers could tutored students others knowledge such as the method of learning and so on.

Table 5: the contents of tutoring

Contents of tutoring	Teachers(percentage)
Basic knowledge	23.46
Knowledge about problem solving	90.21
Method of learning and so on	21.34

3.6 The Process of Teachers' Tutoring

According to the answers of senior high school mathematics teachers, it could be seen that the specific processes of senior high school mathematics teachers' tutoring were various. But it could be organized into 3 categories. That were complementing new mathematics problems and teaching directly, checking the steps and methods of students' problem solving and helping them correct it, and understanding the detailed difficulties of students and instructing them to overcome that. The details of the specific tutoring process were as shown in tale 6. From this table, we could know 63.37% of senior high school mathematics teachers usually adopted the first tutoring process, only 16.67% of senior high school mathematics teachers usually adopted the third tutoring process.

Table 6: the processes of teachers' tutoring

Tutoring process	Teachers (percentage)
complementing new mathematics problems and teaching directly	63.37
checking the steps and methods of students' problem solving and helping them correct it	36.25
understanding the detailed difficulties of students and instructing them to overcome that	16.67

3.7 The Requirements of Teachers' Tutoring

From the answers of teachers who were investigated this time, we knew all senior high school mathematics teachers had requirements for students when they tutored students, however it was different. The detailed requirements that current senior high school mathematics teachers put forward to students were as shown in table 7. From this table, it could be seen that 93.77% of senior high school mathematics teachers generally asked students to master the steps and process of problem solving. Only 6.68% of senior high school mathematics teachers usually asked students to understand the method of problem solving.

Table 7: the requirements of teachers' tutoring

Requirements of tutoring	Teachers (percentage)
Understanding the method of problem solving	6.68
Mastering the steps and process of problem solving	93.77
Mastering the distinguishing features of problems, and knowing how to category and generalize	21.32
others	16.79

4. Discussions

Based on the results above, the current senior high school mathematics teacher's tutoring in extra-curricular time had some characteristics as follows: (1) the main form which the senior high school mathematics teachers adopted was one to one. The percentage of senior high school mathematics

teachers who usually tutored more than one student was only about 40%. (2) The tutoring duration was relatively short. The majority of current senior high school mathematics teachers generally spent within ten minutes, rarely not more than half an hour, on their tutoring in extra-curricular time. (3) The students who were tutored usually by teachers were not comprehensive. The majority of current senior high school mathematics teachers thought highly of the tutoring of outstanding students and middle level students, but hardly took the tutoring of backward students into consideration. (4) The contents of teachers' tutoring were excessively concentrative. The majority of current senior high school mathematics teachers mainly tutored the knowledge about problem solving, hardly ever dealt with other contents. (5) The time, process and requirements of the tutoring were too single. The majority of current senior high school mathematics teachers mainly tutored students during free class time. Besides, the teachers were accustomed to directly complemented and then explained mathematics problems to their students. And the majority of mathematics teachers only required their students to master the steps and process of problem solving when they tutored students.

5. Conclusions and Suggestions

The effects of current senior high school mathematics teachers' tutoring in extra-curricular time were generally not ideal. According to the investigation to 34 current senior high school mathematics teachers and the results above, we thought the reasons were various. Less tutoring duration, excessively concentrative tutoring contents, as well as irrational and unscientific tutoring process and requirements are all the direct reasons resulted in the poor effect. These situations may be related with the senior high school mathematics teachers' actual teaching environment. Currently, the senior high school mathematics teachers usually pay more attention to the students' school scores, especially the outstanding students' scores. At the same time, the teachers were always busy with their daily jobs, their actual teaching time was limited. So, in order to improve the effect of tutoring in mathematics, we suggested that current senior high school mathematics teachers should attach great importance to mathematics tutoring in extra-curricular time, arrange the tutoring time reasonably, and give the students sufficient time and suitable environment; The students who were tutored should be much more, in order to guarantee all students to have chance to participate in the activities of mathematics tutoring and get further development during extra-curricular tutoring time; On the contents of tutoring, we thought that teachers were supposed not only to help students solve the problems and master the knowledge about problem solving, but also to instruct other aspects, such as the learning methods and so on. Through the tutoring in extra-curricular time, the teachers should not only made students understand the problem in depth and master more types of problems, but also improve students' learning ability constantly; During the process of tutoring, teachers would better not answer students' questions or teach students problem solving directly, but inspire the students to think frequently, so as to promote the development of students' thinking ability.

6. References

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