

## **Study of Teachers' Language of Instruction Based on a Video of the Algebra Classroom – such as Two Cases of “The Multiplication and Division of the Fractions”<sup>1</sup>**

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By using the recording and quantitative analysis of two videos about “The multiplication and division of the Fractions” and the “Flanders Interaction Analysis System,” we classified the teachers' language of instruction in algebra classroom and also analysis the language of instruction in the different teaching process. The results after the analysis as follows:

- (1) The proportion of time was taken in teachers' language of instruction is high and vary in types, most of the teachers' language is teachers' question;
- (2) In the different teaching process, the proportion of time was taken in teachers' language of instruction is different;
- (3) Teachers attached importance to explain the example and had the similar teaching strategy, but the teachers' language is different;
- (4) In the practice process, teachers placed importance on exploring the tough question and its teaching strategies are different. The teachers' questions are the main teachers' language of instruction.

*Keywords:* language of instruction, video case, algebra teaching

*MESC Classification:* C23, C70

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## 1. INTRODUCTION

In the “*Recommendations for teachers*,”<sup>2</sup> Sukhomlinsky believed that teachers’ language, for the most part, decide the efficiency of students learning in the classroom (cf. Sukhomlinsky, 1979–1980). Confucius also said that “No elegant words, no exploration.” These demonstrate the importance of teachers’ language of instruction. Teachers’ language of instruction is the main way to transmit messages to students, but they cannot easily pass on their knowledge since the language they must use in order to communicate contains an implicit and serious barrier to learning (Louisa, Veiga, Costa Pereira & Roger, 1989). The basic task of teachers’ language is to impart facts, in the meantime, express their feelings to the students. The teachers also could get the students’ reaction by the students’ language in the classroom. By this way, the teacher obtained the interaction between teacher and students finished the teaching task (National Council of Teachers of Mathematics, 2000). Teachers’ language of instruction influenced students’ learning imperceptibly. The quality and quantity of teachers’ language of instruction affects the results of classroom teaching directly. Therefore, teachers’ language of instruction is worthy of our study.

## 2. OBJECTIVE

This study tried to generalize the type and proportion of teachers’ language of instruction in the classroom teaching and summarize the teachers’ language that could promote the students’ learning and thus advance the classroom teaching through the analysis of 2 videos.

The issues of this study as follows:

- (1) What character is the teachers’ language of instruction?
- (2) How is the relationship between the teachers’ language of instruction and students’ learning?

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<sup>2</sup> “*Recommendations for teachers*,” is a translation of Chinese “给教师的建议.” The bibliographic information for the literature is 苏霍姆林斯基 《给教师的建议》教育科学出版社 1984 年版 421 页. The translation from Russian original literature (cf. Sukhomlinsky, 1979–80) is on the bottom of p. 103 of [Cockerill, A. (1999). *Each One Must Shine: The Educational Legacy of V.A. Sukhomlinsky*. Electronic edition. Sydney, Australia; ERJ Language Service Pty Ltd. Retrievable from: [http://www.ejr.com.au/sukhomlinsky/Each\\_One\\_Must\\_Shine\\_2009.pdf](http://www.ejr.com.au/sukhomlinsky/Each_One_Must_Shine_2009.pdf) ]

### 3. METHOD

#### 3.1 Participants

The main difference between teachers of their language awareness was in their interaction with the context in which they worked (*cf.* Andrews, 2006).

We chose the teachers from Hangzhou Binxing School. The school was selected as the site for this research based upon the act that we had a long-term cooperative relationship with it and the teachers were interested in participation. We began class observing, evaluating and shooting classroom video for 1 year. We codes teachers as teacher A and teacher B. The content of their teaching is "The multiplication and division of the Fractions" (the first half of the 7th grade).

These 2 teachers have 3 years' experience in teaching. These teachers actively participated in year-long lectures, class evaluating. Consequently, both the teachers and the students had adapted to have video cameras in the classroom, so that we can show normal classroom teaching as much as possible.

#### 3.2 Method

The TIMSS Video Study and Video Case Study (Leung, 2005) will be used for reference in this study. Through observed the video repeatedly, we developed the transcripts of classroom teaching, which included the teachers and students' language in the classroom, and then we coded and classified the teachers' language of instruction and drew some conclusions and inspiration. The specific analytical method as follows:

- Firstly, we observed in the classroom teaching and the same time videotaped the lesson, after the class, we caught on the teachers and students' background by interviewed the teacher and students.
- Secondly, we recorded the whole lesson which include teachers and students' all kind of languages and behaviors, and also recorded the time.
- Thirdly, we classified the acts of teachers' language of instruction in each lesson and counted the frequency and corresponding time of teachers' language.

#### 3.3 Date collection

We used two cameras to shoot video of the teacher and the students respectively in the process of classroom teaching, and then reviewed the video. During this process, we performed three tasks: Firstly, recorded the whole teaching process with a text, which included the teachers and the students' language and the supplementary description of the classroom. Secondly, recorded the beginning and ending time, including its period of

length. Thirdly, added some details to the teaching, such as teachers' line of walking line, facial expression, voice tone, and so on. The brief introduction to the process of arrangement is just as follows:

### **3.4 Coding and analyzing**

After the recording and statistics, we did some quantitative analysis on the statistics.

#### ***3.4.1 Coding the type of teachers' language of instruction***

We counted all kind of teachers' words in the classroom teaching as teachers' language of instruction. According to the role of teachers' language of instruction, Ned Flanders, American educator, advanced "Flanders Interaction Analysis System" in 1960s and divided teachers and students' language into 11 types (Flanders, 1970, p. 34). Combined with the classroom observation and video analysis, teachers' language was codes as feedback, incentive, inspiration, common language, question, statement and command. Feedback, incentive, inspiration and common language belong to the teachers' language caused by students and the others belong to the teachers' language caused by teacher. The special definition as follows:

- (1) Feedback: Teachers accept or clarify the students' attitude or emotion with the non-threatening language.
- (2) Incentive: Teachers encourage the students because their language, acts in the classroom.
- (3) Inspiration: Teachers inspire the students based on the students' answer.
- (4) Common language: When the students' answer is right, teacher and all of the students repeat the answer together in order to deepen the students' memory.
- (5) Question: The teachers ask a question about the classroom knowledge.
- (6) Statement: The teachers express their own ideas or explain the knowledge.
- (7) Command: The teachers call the students to do something in the classroom.

Moreover, we made an agreement: Teachers' every complete language was recorded as once language.

#### ***3.4.2 Coding the type of students' response***

According to the complexity of student's response, this was coded as no answer, mechanical, memorized, comprehensive, and 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. RESULTS AND DISCUSSION

**4.1 In the algebra classroom, the proportion of interactive and conversational time between teacher and students is more than 55%. The proportion of time that was taken in teachers' language is more than 40% and varied in types, most of the teachers' language is teachers' question**

As seen from Table 1, teachers' language is the primary form of classroom teaching. The frequency of two teachers' language of instruction is different, teacher A is 111 and teacher B is 261, both of the proportion of time that was taken in teachers' language is more than 40%.

**Table 1.** The analysis of teachers' language and students' response in algebra classroom

Teacher	Teachers' language			Students' response		
	frequency	Time(s)	Proportion of time	frequency	Time(s)	Proportion of time
A	111	988.5	41.60%	59	351.5	13.88%
B	261	1181	46.64%	160	356.5	14.08%

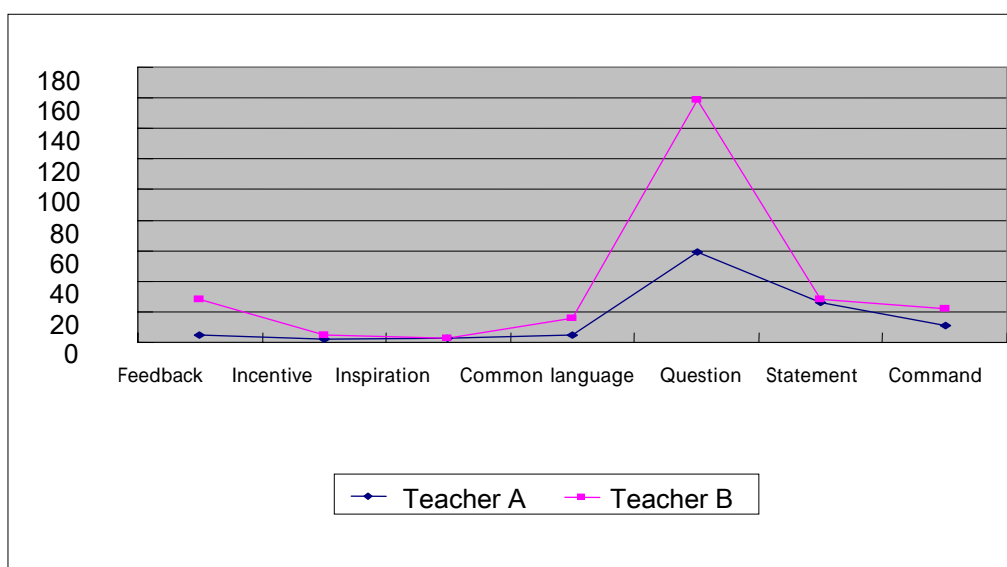


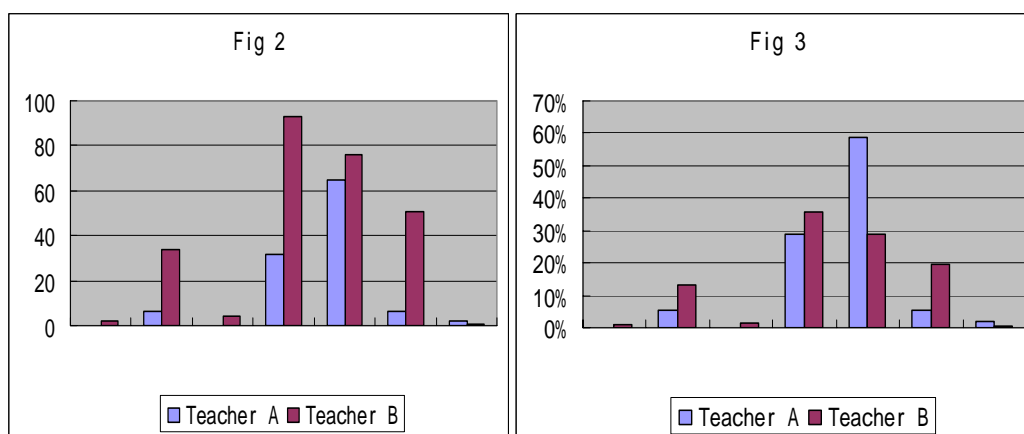
Figure 1. The statistics of two teachers' language of instruction

The proportion of time that was taken in students' language in the classroom is 13.88% and 14.08% respectively. We can see from that the interaction and conversation between teacher and students are the main teaching behavior, the proportion of that is more than 55%. According to the transcripts of classroom teaching, the proportion of all kinds of teachers' language of instruction is different, but on the whole the "question" and "statement" are more than others and "question" is most of all the teachers' language, which is 1.5 times longer than other teachers' language Figure 1. In other words, most of the teachers take the question as the main teaching behavior in the classroom

Consequently, in the algebra teaching process, teachers should pay attention to their language in the classroom. Teachers should follow a series of principles on language of instruction: accurate, concise, logical, inspirational, vulgar, artistic and so on. Using the teachers' language of instruction suitably and reasonably will get a multiplier effect of teaching and also greatly improve the teaching efficiency.

#### 4.2 In the different teaching process, the proportion of time that was taken in teachers' language of instruction is different

According to the content of two teachers' classroom teaching, the process of teaching was divided into prepare, introduce, construct, explain the example, practice, summarize and finish. Although two teachers' frequency of language is different in the whole teaching process, the proportion of teachers' language in all kinds of teaching process is close.



: prepare; : introduce; : construct; : explain the example; : practice;  
: summarize; : finish

Figure 2. The frequency of two teachers' language in different teaching process

Figure 3. The proportion of two teachers' language in different teaching process

### 4.3 Teachers attached importance to explain the example and had the similar teaching strategy, but there is difference in two teachers' language and the results of teaching is significantly different

Based on the comparative analysis, we found that both of the teachers focused on the process of “explain the example” and “practice”. They used many questions in these processes. Teachers adopted analogy to taught fraction's multiplication and division rule, both of them taught the rules from “fraction's multiplication and division rule” to “fractions' multiplication and division rule.” Teachers' instructional strategy is similar, they selected the same examples. The first question was

$$\frac{6a \cdot 2y^2}{8y \cdot 3a^2},$$

which was used to emphasize the reduction of a fraction. The second question was

$$2ab \div \frac{-3b^2}{a},$$

which was used to guide the students to get the fractions' multiplication and division rule. Both of the teachers had the reflection after the problem. At first, teacher A showed the definition of fraction's multiplication and division rule, and then told the students to solve the calculation about fraction's multiplication and division by the analogy. But the teacher B explained the example first, then obtained the rule by asking the students to compare the fraction's multiplication and division rule.

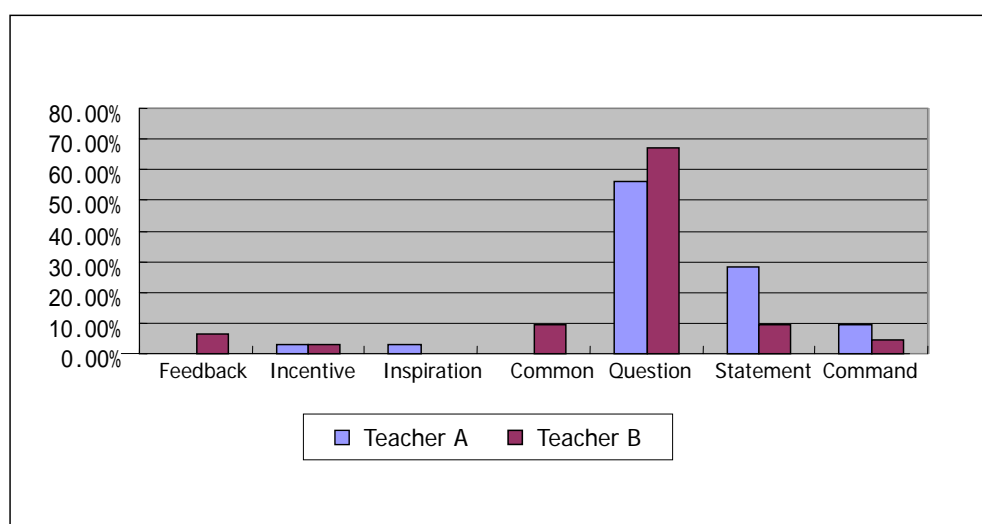


Figure 4. The comparison of two teachers' language in the process of “explain the example”

From the students' feedback, we can see the transition from "fraction" to "fractions" is a better choice. The teachers selected the same example and adopted the similar instructional strategy; nevertheless the rule was given by the different order, so that two teachers' language of instruction is different. In the process of "explain the example", the proportion of teachers' questions is 56.25% and 68.82% respectively, but the proportion of statement of teacher A is about 3 times than teacher B. Figure 5 displays there are more comprehensive response in teacher A's classroom, the proportion of that is about 50%, but the in the teacher B's classroom, the proportion of comprehensive response is only 39.06%. This shows that using the "statement" could help students to understand the knowledge better, however, overfull questions couldn't achieve significant results.

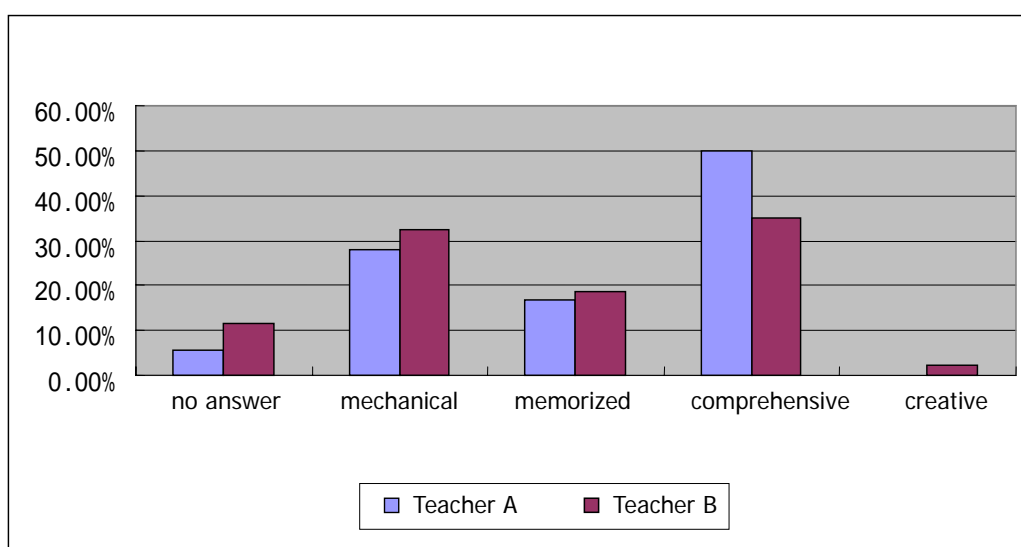


Figure 5. The comparison of students' response in the process of "explain the example"

#### 4.4 In the practice process, teachers placed importance on exploring the tough question and its teaching strategies are different. The teachers' questions are the main teachers' language of instruction

We divided the process of "Practice" into "basic training" and "exploratory training". The content of "basic training" is about the multiplication and division of monomial, the time was taken in that is similar, teacher A and B spent 199.5 seconds and 288.5 seconds on that respectively. We found that two teachers' teaching methods are similar, because the content is simple; they corrected the answers after students' independent exercise. As seen from Fig 6 and Figure 7, both of the teachers used many questions, the proportion of that are all above 50%. But the mechanical response was the students' main responses and



the proportion of that time was 50% and 70% respectively.

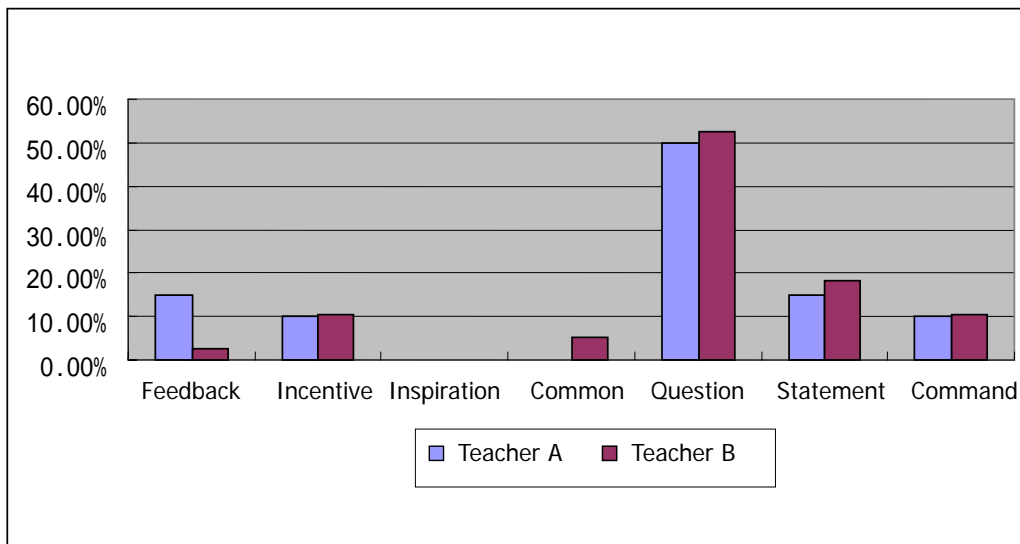


Figure 6. The comparison of two teachers' language

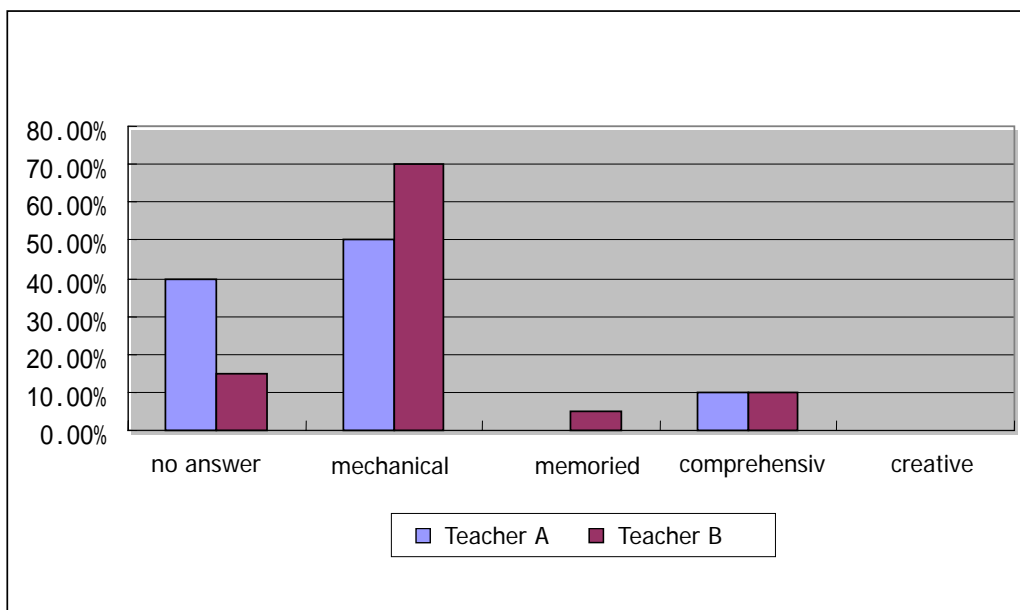
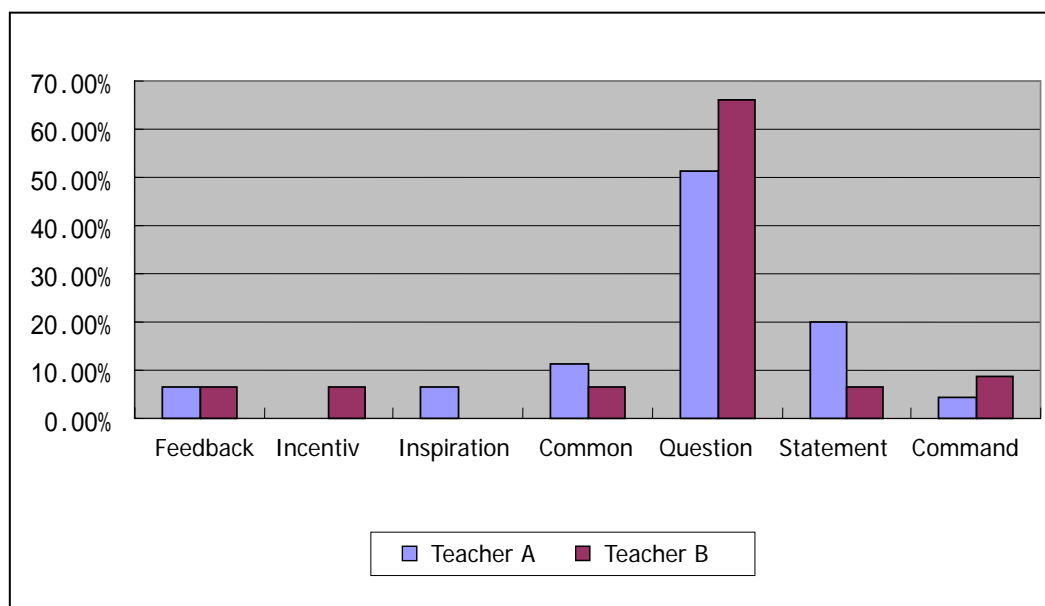


Figure 7. The comparison of students' response in two classroom teaching

The content of “exploratory training” is about the multiplication and division of polynomial. This process was harder than “basic training”, which not only requested the

students to use the skills such as reduction of a fraction and the rule of multiplication and division, but also demanded the students to acquire the integrated capability of factorization. We discover that the teachers' instructional strategies were different, the instructional mode of teacher A as follows: students' attempt → students' answer (detected the error) → guided the students methods about how to solve problems → guided the practice → summarized solution approach. The instructional mode of teacher B as follows: introduced the solution approach → students' application → students' answer (detected the error) → corrected the error → strengthened the solution approach → consolidated practice by the students. The specific teaching performance was that teacher A let the students to solution firstly, and then according to the students' answer to give the guidance. At the same time, the teacher emphasized the norms of solution and something that need particularly noteworthy when the process of interaction between teacher and students. Teacher B showed a set of polynomial exercises and let the students to compare the difference between the polynomial and monomial, which can help students to recall the factorization and the formula for the difference of squares, then had the students to do some exercises, and teacher B gave some instructions in the process of checked answers.



*Figure 8.* The comparison of two teachers' language in the process of "exploratory training"

By the comparative analysis, we found that both of the teachers used many questions. The proportion of teachers' questions was 50% and 65% respectively, but the frequency

of “statement” and “common language” of teacher A was more than teacher. Combined with the classroom observation and video analysis, it was obvious that the instructional mode about solution of teacher A could inspire students' interest better and the classroom atmosphere was active, which could led to deeper mathematical thinking.

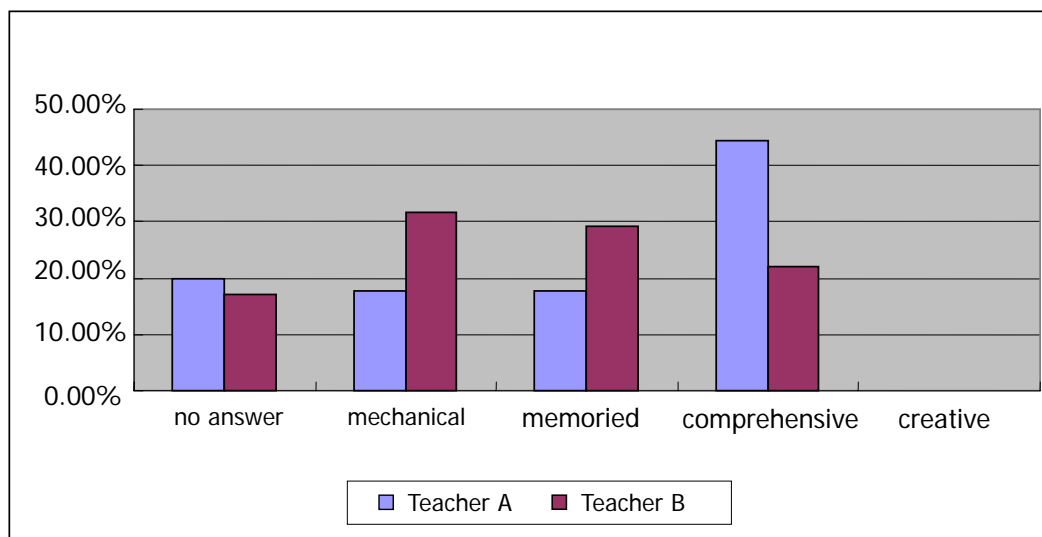


Figure 9. The comparison of students' response in the process of “exploratory training”

In the process of summarize, the question was also the main teachers' language, they let the students to summarize the rule of multiplication and division by asking question.

In the algebra classroom, more than half of the classroom time was taken in the interaction and conversation that between the teacher and students. In the different teaching process, the proportion of time was taken in teachers' language of instruction is different, and the teachers' questions are the main teachers' language of instruction. Through the study, we found that the “statement” could advanced the students to understand the knowledge better, but the quantities of teachers' questions didn't lead to significant difference in students' achievement.

## 5. Further discussion

- (1) How to distinguish a good teacher's language exactly in the algebra classroom?  
What kind of teacher's language can inspire the students' interest in mathematics and how to influence the students' achievements?
- (2) How to improve the ability of teachers' language of instruction?
- (3) What proportion of teachers' language was used in classroom is appropriate? What is

the relationship between the teachers' language and teaching quality?

- (4) What kind of teachers' language can fit in with the ability of students' mathematics?
- (5) Study why the quantities of teachers' questions can't lead to significant difference in students' achievement and try to find out the effective question that can advance the student to understand the knowledge better.
- (6) Study the relationship between teachers' language and students' mathematics learning by student assessment.

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