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Opportunity to talk and Mathematics Teaching in Chinese Mainland

Yiming Cao
Shuan Liao
Yulei Wan
Beijing Normal University, China

Based on the videos of LPS (The Learner's Perspective Study) and TIMSS1999, this paper has made quantitative analysis of utterances during mathematics lessons in Chinese mainland (Beijing and Shanghai). According to the comparison of the results of our work and other existing studies, the differences of opportunities of talk in mathematics lessons between Chinese mainland and other countries is investigated. The interaction between teachers and students in Chinese mainland is also studied.

***Key words*:** TIMSS, number of words spoken by teacher and student, interaction, teacher-student relationship.

Problem Formulation

Related research work shows that in the eighth-grade mathematics lessons of many countries, teachers speak most of the time while students only listen. Whether this is good for students is a controversial topic. Some researchers think that giving students more opportunities to talk increases the interaction between teachers and students, which is good for learning. However, it is also believed by some researchers that more low level opportunities of talk for students are ineffective. China has not taken part in this project. Similar research work has not been launched. This paper does some work in this aspect.

Teacher and student are two basic elements in the educational system. The teacher-student relationship is an important research topic of mathematics lessons. A new teacher-student relationship guarantees the carrying out of the New Curriculum Reform. The New Curriculum emphasized interaction and inquiry-based teaching. The topics of this paper are the interaction in lessons in China, differences between lessons and the comparison with other countries. Research is made from these two aspects: the number of words spoken by teacher and student and the ratio of teacher and student talk. We hope to do some quantitative analysis. The results of this paper are the foundation of further research work.

According to TIMSS1999, participation, talk and communication of students during mathematics lessons were studied. Countries participating in this work include Australia, Czech Republic, Hong Kong, Japan and, Netherlands and the Unite States.

All the lessons were translated from the respective native languages. Transcriber /translators were fluent in both English and the language of the country whose lessons they translated. The comparison of numbers of words spoken by teachers and students in mathematics lessons was made. The research object was the eighth-grade mathematics lessons. Conclusions drawn by studies related to TIMSS1999 include: (1) the eighth-grade mathematics lessons in all the countries revealed many brief opportunities (1~9 words per utterance) for students to talk. (2) The eighth-grade mathematics lessons in all the countries revealed few long opportunities (more than 10 words) for students to talk. (3)This is similar to the pattern often reported in the literature, in which teachers talk and students listen (Cazden, 1988; Goodlad, 1984; Hiebert & Wearne, 1993; Hoetker & Ahlbrand, 1969; Tharp & Gallimore, 1989). In other words, the conclusion is that in eighth-grade mathematics lessons, teachers talk the majority of the time while their students are listeners. This phenomenon is especially reflected in Hong Kong.

Chinese Mainland did not participate in this project. Therefore, based on similar methods, we have made analysis and comparison of 15 seventh-grade mathematics lessons of three teachers from Shanghai and Suzhou (SH1, SH2 and SZ). Since these three teachers are locally excellent teachers, the study can reflect the interaction of teachers and students in cities of Chinese Mainland. The results are also compared with teachers from other countries using data of TIMSS1999.

Based on The Learner's Perspective Study [LPS] project, the study has chosen 15 representative seventh-grade mathematics lessons of three teachers from Shanghai and Suzhou and makes analysis and comparison. The beginnings of the lesions are deleted to make sure that the samples can reflect real situations.

Design of research

It is required that in a country (region) at least 10 to 15 continuous lessons of 3 representative eighth-grade teachers are chosen (Since the mathematics knowledge is taught in seventh-grade in Chinese mainland, the videos from Shanghai and Suzhou are collected in seventh-grade). For each lesson, three cameras were used to capture the images of the teacher, the whole class and four focused students. A technique of on-site mixing of the images from two video cameras to provide a split-screen record of both teacher and student actions was used. Sixteen countries (regions) participated in this project, including China (Hong Kong, Macao, Beijing, Shanghai), Australia, the U.S., Germany, Netherlands, Japan, Korea, Singapore and Czech. Since the study is based on videos of continuous lessons (usually 10 to 15 lessons) taught by excellent teachers from each country, the results are authentic.

The research makes quantitative analysis of collected data. It includes three aspects, which are the total number of words spoken by teachers and students, the ratio of teacher to student talk and the length of each utterance. The total number of words spoken by teachers and students reflects the capacity of lesions. The ratio of teacher to student talk is used to study the teacher-student relationship in lessons. This ratio is also utilized with the data of TIMSS1999 to make international comparisons. The

length of each utterance is used in the analysis of interaction between teacher and student. Through the length of utterance of teachers, the degree of lessons and how much attention is paid to students are observed. On the other hand, the degree of feedback and interaction between teacher and student is seen according to the length of the utterance of students. We first apply the statistics to the overall situation, and then analysis and comparison of different teachers are made.

Result and analysis of the study

Illustration

(a)The teacher from Shanghai is labeled as SH1; the other teacher from Shanghai is labeled as SH2; the teacher from Suzhou is labeled as SZ. (b)We choose to research the 6th to 10th lessons from the two Shanghai teachers to research. (c)We choose to research the 2nd to 6th lessons from Suzhou teacher to research.

Analysis of the whole 15 lessons

Table 1

Descriptive Statistics

	N	Mean	SD	Min	Max
Number of words spoken by teacher	15	5976.13	1559.23	3261.00	8684.00
Number of words spoken by student	15	630.33	232.21	166.00	1003.00

The above description statistics show that, in 15 mathematics lessons by the 3 teachers, the average number of words spoken by the teacher is 5976.13. This is much greater than 630.33, which is the average number of words spoken by the student.

For quantitative analysis, description statistics mainly abbreviate a great deal of data into representative numbers, making them reflect the full view of the data. Based on description statistics, further statistics and analysis can be made. However, relying only on description statistics, it is not possible to conclude that the number of different teachers and students are different. Therefore we must make inferential statistics to prove that the difference really exists.

Based on description statistics, inferential statistic infers from samples to universe. Inferential statistics includes parametric test and nonparametric test. Parametric test is always based on some assumptions, for example, normality of distribution. In this project, the lessons of four teachers from Beijing and Shanghai are compared to see whether differences exist. Since we only have video of five lessons of each teacher, the requirement of analysis of variance is not satisfied. Parametric test is apparently not proper. Therefore, nonparametric test is adopted. The Crukal-Wallis H is used to compare the average numbers.

Table 2

Cruskal-Wallis H

	Number of words spoken by teacher	Number of words spoken by student
Chi-Square	10.580	5.470
Df	2	2
Asymp. Sig.	.005	.065
Exact Sig.	.000	.058
Point Probability	.000	.001

The conspicuous capacity difference between words (similar content) of different teachers

According to the above statistics, in the lessons studied, the Exact Sig. probability of number of words spoken by teacher is .000<0.05, the Exact Sig. probability of number of words spoken by student is .058≈0.05. This displays that the capacity difference between words of different teachers is conspicuous.

The conspicuous difference of the ratio of teacher and student talk between different teachers

Dividing the average number of words spoken by teacher by average number of words spoken by student, we present the ratio of teacher and student talk, which is 9.5. This shows that in the sampled lessons, teachers taught in the majority of the time while students listened at most of the time. This is similar to the conclusion drawn by TIMSS1999 (Cazden, 1988；Goodlad, 1984；Hiebert & Wearne, 1993；Hoetker & Ahlbrand, 1969；Tharp & Gallimore, 1989).

The conspicuous difference of lesson capacity between different teachers is observed from the statistics results. However, the difference of the ratio of teacher and student talk is not conspicuous. This illustrates that, in different classes, when the capacity of teacher's words varies, the capacity of students' words will present a similar variation, which results in that the ratio of words of teacher and students does not vary significantly. The three classes studied in this paper are representative. It is needed to make more analysis and comparison of these three teachers.

Individual difference analysis

Table 3

Mann-Whitney U

Exact Sig.(2-tailed)	Number of words of teachers	Number of words of students	The ratio
SZ&SH1	.032	.952	.151
SH1W& SH2	.032	.032	.310
SZ& SH2	.008	.095	.690

The conspicuous capacity difference between words (similar content) of different teachers

The comparisons of each two teachers were made. For the number of words of teachers, any two teachers have a conspicuous difference. For the number of words of student, only the results of SZ and SH1 are close, and any other two teachers have a conspicuous difference. Therefore, the difference of lesson capacity of these three teachers is conspicuous.

The similarity of the ratio of teacher and student talk between different teachers

For the ratio of teacher and student talk, any two teachers have a similarity.

According to the above analysis, we see that the difference of lesson capacity of these three teachers is conspicuous, but the ratio of teacher and student talk of these three teachers is similarity. This illustrates that the words spoken by teacher and student have relation with each other. Thus, we make further correlation analysis to study the relationship between the number of words spoken by teacher and student.

Table 4

Correlation Analysis

Pearson Correlation	Number of words spoken by student	Number of words spoken by teacher	Ratio of teacher and student talk
Number of ords spoken by student		.831(**)	-.542(*)
Number of words spoken by teacher			-.881(**)
Ratio of teacher and student talk			

The results show that the number of words spoken by teacher and student are positively related, the number of words spoken by teacher and the ratio of teacher and student talk are negatively ralated, and the number of words spoken by the stuent and the ratio of teacher and student talk are negatively ralated. Since a smaller ratio of teacher and student talk indicates a more active lesson, we intuitively believe that a smaller number of words spoken by the teacher and a greater number of words spoken by student will result in a more active lesson. However, the situation is not the same in this project. We found that, the greater the number of words spoken by teacher, the greater the number of words spoken by student, the smaller the ratio of teacher and student talk, which indicates a more active lesson. The reason is that in the lessons in Chianese mainland, the words spoken by the teacher occupy the mojority time. If teacher only teach knowledge, the number of words spoken by teacher is greate and the number os words spoken by the student is small, which result in a greate ratio of teacher and student talk. If teacher makes more interactions with students besides teaching knowledge, the number of words spoken by teacher is greater. Meanwhile, the number of words spoken by student is also greater, and the ratio of teacher and student

talk is smaller. The lessons are more active.

The number of words spoken by teacher and student in mathematics lessons is close between Chinese mainland with Hong Kong, and different from other countries

Assume that the ratio of teacher and student talk does not change after translating into English. In the videos, the ratio of average number of words spoken by teacher and student is 9.5. The result is plotted along with Hong Kong, and different from other countries.

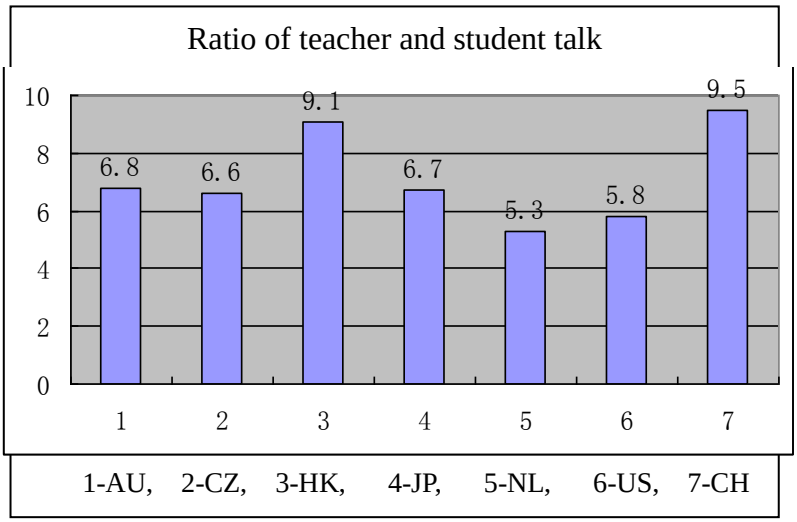

Figure 1. **Ratio of teacher and talk.**

Note. AU=Australia; CZ=Czech Republic; HK=Hong Kong SAR; JP=Japan; NL=Netherlands; US=United States; CH=Chinese Mainland. Source of data outside of Chinese mainland in the above table: James Hiebert, Teaching mathematics in seven countries results from TIMSS 1999 video study, Chapter5, instructional practices: How Mathematics Worked Was On, page122，figure5.14.(Data of this chart has been converted.)

It can be observed from the above figure that the ratio of number of words spoken by teacher and student in Chinese mainland is greater than the international average value (6.7). This ratio of Chinese mainland is 9.5, which is followed by HK, whose ratio is 9.1. This illustrates that the interaction levels of both Chinese mainland and HK is significantly different from those of other countries. This phenomenon, in some extent, reflects that the interaction and the relationship are internationally different.

The regular of number or words spoken by teacher and student in mathematics lessons

When we make description statistics of the number of words spoken by teacher and student, we have:

Table 5

Descriptive Statistics for Number of Words Spoken by Teacher and Student

	SZ	SH1	SH2
Length of teacher utterances (1-4)	0.16	0.05	0.08
Length of teacher utterances (5-24）	0.41	0.33	0.34
Length of teacher utterances (more than 25)	0.44	0.64	0.57
Length of student utterances (1-4)	0.74	0.56	0.72
Length of student utterances (5-10）	0.15	0.19	0.17
Length of student utterances (more than 10)	0.11	0.24	0.11

For all three teachers, the distributions of length of each utterance present great consistence. Percentage of utterances containing 1 to 4 words is small, while percentage of utterances containing more than 25 words is great. What is more, the comparison of SH1 and SH2 are similar. For both of them, the percentage of utterances containing 1 to 4 words is less than 10%, while the percentage of utterances containing more than 25 words is more than 50%. For SZ, the percentages of utterances containing 5 to 24 words and utterances containing more than 25 words are similar.

About the length of student utterances, comparison of SZ and SH2 present high consistence. Majority of student utterances contains 1 to 4 words. The percentage of utterances containing more than 10 words is low. In classes of SH1, percentage of student utterances containing more than 10 words is greater that those containing 5 to 9 words, which reflects that students of SH1 are more active.

Generally speaking, for all these three teachers, the percentage of student utterances containing more than ten words is lower than one-third, which demonstrates that the degree of interaction between teachers and students is limited. More than half of the teacher utterances are long utterances. This illustrates that the knowledge is thoroughly introduced. Teachers are inclined to present more knowledge but pay less attention to students.

Introspection

In this paper, we apply the research methods of TIMSS1999 to the study of teacher-student relationship in China, endeavoring to present the differences of lessons between different teachers, making a further study of a greater number of samples as possible. The results show that there exist conspicuous differences between lessons of different teachers.

Although the results are influenced by the speaking customs of teaches, we can still draw the conclusion that the relationship of teachers and students and the teaching pattern are conspicuously different between lessons of different teachers. The high value of the ratio of teacher and student talk also reflects the basic situation that most of the time teachers teach knowledge. The parameter chosen by quantitative analysis is only one measurement of lessons and only reflects one aspect. For a study with more complexity, quantitative analysis is not enough. More aspects and characteristics must

be considered to obtain more valuable conclusions.

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Authors:

Yiming Cao
Beijing Normal University, China
Email:caoym@bnu.edu.cn

Shuan Liao
Beijing Normal University, China
Email: liaoshuangbnu@yahoo.com.cn,

Yulei Wan
Beijing Normal University, China
Email: wangyulei0215@163.com,