

# Investigation Report on the Situation of Mathematics Reading Instruction

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*The main aim of the study reported in this paper is to identify the current situation of Mathematics Reading instruction. The study is done by conducting two surveys which are “the Situation of Mathematics Reading Learning” (32 items, 7 dimensions, for students) and “the Situation of Mathematics Reading Teaching” (14 items, 2 dimensions, for teachers). The results show a declining trend from Grade 7 to Grade 12. There is a gradual decline in the performance of Mathematics Reading from junior students to seniors. The interest, attitudes and habits of middle school students to Mathematics Reading are not positive. Teacher’s cognition to Mathematics Reading remains in a state of unconsciousness.*

**Key words:** Mathematics reading, investigation, interview

Reading is an important part of human life and it’s also the principle means to acquire knowledge and know the world. Mathematics Reading is a basic skill in Mathematics learning. Varieties of learning styles such as reading and learning by oneself are emphasized in the “Mathematics Curriculum Standards” of compulsory education and high school. In recent years, higher demands on Mathematics Reading ability for students are also proposed in the college entrance examination. Therefore, Mathematics teachers should have proper views of Mathematics Reading, know its educational functions, integrate Mathematics Reading into Mathematics instruction, and use certain strategies to guide students' Mathematics Reading. What is the current situation of Mathematics Reading instruction in practice? We conducted a survey.

## Methods

### Participants

Eight hundred and eighty four Chinese students from Grade 7 to Grade 12 participated in the study. They came respectively from an ordinary high school, a key middle school and a private school in Shanxi Province. The number of validated questionnaires was 861.

One hundred Chinese Mathematics teachers from four middle schools participated in the study. The number of validated questionnaires was 82, in which 39 were from junior high school, accounting for the total number of 47.6%, and 43 were from senior high school, accounting for 52.4%. Apart from 3 people defaulting (accounting for 3.7%), there were 25 male teachers, accounting for 30.5%, and 54 female teachers, accounting for 65.8%. In addition, 42 teachers had less than 10 years' experience, 26 teachers had less than 20 years experiences and 12 had more than 20 years experiences.

The answers to the final 3 open-ended questions showed that some teachers were interested in Mathematics Reading because their answers were particularly detailed. Therefore, researchers made a return visit and asked whether these teachers were willing to be interviewed. Finally, eight teachers were interviewed.

### **Instruments**

Two questionnaires, "Situation of Mathematics Learning" (32 items, 7 dimensions, for students)" and "Situation of Mathematics Teaching" (14 items, 2 dimensions, for teachers), were used to investigate the current situation of Mathematics Instruction. Before forming the official questionnaire, an expert consultation, an interview and a pre-investigation on the primary level were conducted. Pre-set questionnaires were handed out to specific Mathematics teachers and their suggestions were collected. Experts made some constructive comments especially regarding each item's clarity and content relevance. In the beginning of the pre-survey questionnaires, the participants were encouraged to make related comments such as whether the expressions on the text were clear, or were misleading, had unnecessary questions, as well as whether they were incorrect, inappropriate and so on. Finally, a student questionnaire containing 31 objective questions and 1 open-ended question and a teacher questionnaire containing 13 objective questions and 3 open-ended questions were formed respectively.

The student questionnaire consisted of seven dimensions which addressed views of Mathematics Reading, reading motivation, reading interest, reading habits, reading strategies, reading metacognition and reading abilities. Reading habits, reading strategies and reading metacognition were emphasized. Teacher questionnaires consisted of two dimensions which addressed views regarding Mathematics Reading teaching and teaching methods of reading.

## Results

### Reliability and Validity Analysis

Cronbach alpha coefficient was 0.754, Standardized value was 0.836, and Spearman-Brown split-half reliability was 0.831. These showed that the scale had good reliability. The experts' expounding and proving ensure the scale content validity. After the statistical test, the correlation coefficients between each sub-dimension as well as that between each sub-dimension and total score were significant at 0.01 levels. The correlation coefficients between each sub-dimension and total score were higher than those between each sub-dimension which indicated that each sub-dimension made contribution to the total scale and simultaneously each sub-dimension also had certain mutual independence. These showed that the questionnaires had good structural validity.

The average performance composed of the students' midterm, final and a monthly exam during the semester was taken as participants' final academic performance. The scatter diagram of Mathematics academic performance and the questionnaires test result showed that the two were linearly correlated. The Pearson correlation coefficient was 0.368 and  $p=0.00<0.01$  which showed that there was significant positive correlation between them and that the questionnaire had good criterion-related validity.

### Results

The statistical analysis showed that the questionnaires' scores of the public common school, the public key middle school and the private school were, in turn, 65.63, 65.10 and 62.35. The scores of the questionnaires of the public school were higher than those of the private school and there was a significant difference between them at 0.05 levels. There was a significant difference between public common schools and private schools scores at 0.01 levels and the scores of the common schools were higher than those of the key middle schools and there was no significant difference between them.

The average scores of the participants were, in turn, 68.57, 66.48, 66.24, 63.17, 58.46, 62.56 from Grade 7 to Grade 12, and they showed a downtrend on the whole. There was no significant difference between every two grades, specifically, Grade 7, Grade 8 and Grade 9. There was a significant difference between junior high schools and senior high schools. There was a significant difference between Grade 10 and Grade 11 at the 0.01 levels and there was no significant difference between Grade 10 and Grade 12. There was a significant difference between Grade 11 and Grade 10 at the 0.01 levels and there was no significant difference between Grade 11 and Grade 12 at the 0.05 level.

**Views Regarding Mathematics Reading, Reading Motivation and Habit**

Data showed that 80.1% of the participants thought that reading was important for Mathematics learning. Still 9.5% of the participants thought that reading was beneficial only for learning the Chinese language and the English language and Mathematics learning was only for solving Mathematic problems. About 8.8% of the participants considered that items such as theorem, formula and samples in Mathematic books should be lectured by teachers and it was unnecessary to read them. In addition, 1.5% of the participants thought Mathematics was too difficult to read.

Most participants' reading motivation was positive. About 54.6% of the participants chose "reading is an important method for Mathematics learning". Only 24.2% of the participants thought they liked Mathematics. Most of them had a positive attitude towards Mathematics Reading. About 43.2% of the participants thought that they often consulted related material to solve the problem when they had trouble during reading. While 30.5% of the participants thought they focused their attention when reading a Math book.

The survey results of Mathematics reading interest and habit worried us. For the question "Do you like reading Mathematics books?", 57.3% of the participants chose "do not like Mathematics Reading", 8.8% of the participants chose "read Math occasionally", 1.3% of the participants chose "never read", only 32.6% of the participants chose "like and read frequently". Regarding reading habits, 25.1% of the participants chose "usually read Math reference book, Math popular science readings and mathematician biography after school" and only 23.2% of the participants chose "read Math textbook usually".

The above results indicated that most participants' views, attitude and motivation regarding Mathematic Reading were proper and positive. They understood the importance of Mathematic Reading but their reading interests and habits were not optimistic. About 67.4% of the participants seldom or never read Math textbooks after class. The role of math textbooks was served to present problem sets. This situation is related to whether Mathematics teachers guide students consciously to read Math textbooks in the class. Only 14.9% of the participants chose "teacher leaves much time to read" and others chose "teacher leaves little or hardly any time to read". Unexpectedly, 75% of the participants read textbooks "less" and "rarely" after school.

**Reading Strategies**

Did students use any strategies such as questioning, underlining key points, summarizing and introspecting in Mathematics Reading? We made a special investigation regarding these. Data showed that when reading Math textbooks, 17.2% of the participants chose "questioning usually", 36.2% of the participants chose "connecting old contents usually, 70.6% of the

participants chose “underlining key points usually”, 39.0% of the participants chose “taking notes usually”, and 47.3% of the participants chose “using graphics usually to improve understanding”. After reading, 21.8% of the participants chose “summarizing usually”; 15.0% of the participants thought they knew Mathematics Reading methods. Metacognitive strategies used in Mathematics Reading process are shown in Table 1.

Table 1  
*Metacognitive Strategy in Mathematical Reading Process*

Reading strategies	Options (%)			
	Frequently	Sometimes	Occasionally	Never
Introspect on reading content	23.7	64.9	10.9	5.0
Introspect on reading methods	15.9	54.8	26.2	3.1
Adjust own thought timely	40.3	52.9	6.2	6.0
Rethink the related definitions	42.9	47.8	6.8	2.5
Associate with the mastered methods	42.3	50.5	5.5	1.7
Turn new questions into familiar ones	36.3	53.3	8.0	2.3
Introspect on reading content	23.7	64.9	10.9	5.0

Table 1 shows that participants are spontaneous in using reading strategies. Only 27.3% of the participants were satisfied with their reading methods. Most participants urgently needed teachers' instruction, since some participants answered in the open-ended question: “I did not know the mathematical reading before, and I do not have the experience ... do not know how to read ... but long for Mathematics Reading very much”, “Some materials cannot be understood in the process of reading, even when they are read repeatedly ... I really want to get some good reading strategies and please help me.”

### **Reading Comprehension**

The survey results showed that 21.3% of the participants understood the large part of the reading material when reading by themselves. About 59.1% of the participants could understand the majority, and the others could only understand a small part or little. As for the question “Can you find or understand the concealed information or conditions in the topic” about 36.7% of the participants chose “being able to find or understand them”, and 56.5% of the participants thought they “sometimes” and others “never” can.

The survey results indicated that students' reading ability was barely satisfactory. The main reason is that students have no proper reading skills and

methods. Only with the correct reading methods and skills, can students understand the material correctly.

### **Reading Difficulties**

In order to objectively know the difficulties the students had in the Mathematics Reading, we designed the open-ended questions in the questionnaire. We classified the reading difficulties of the participants by the external factors and the internal factors. The external factors were mainly regarding Mathematical language. The internal factors were mainly regarding the intelligence factors and the non-intelligence factors. The intelligence factors were referred to the elementary knowledge and the basic skill. Non-intelligence factors were referred to attitude, habit, interest, and dependence. The detailed statistical results are as follows:

(1) The difficulties of intelligence factors accounted for 44.8%. Among the intelligence factors, elementary knowledge accounted for 13.4%, the reading methods accounted for 10.0%, the connection between the new and the prior knowledge accounted for 9.3%, the ability of understanding the material accounted for 5.5%, the train of thought accounted for 3.3% and the flexibility accounted for 3.3% respectively.

(2) The difficulties of non-intelligence factors accounted for 45.4%. Among the non-intelligence factors, the attitude accounted for 23.9%, the will accounted for 9.7%, the interest accounted for 5.7%, the habit accounted for 4.2% and the dependence accounted for 1.9%.

(3) The difficulties of Mathematics language accounted for 9.8%. Among the difficulties of Mathematics language, the written language accounted for 7.6%, the symbolic language accounted for 1.4% and the diagram language accounted for 0.8% respectively.

Scoring and Analysis of the Teacher Questionnaire

Reliability Analysis and Validity Analysis

Cronbach alpha coefficient was 0.529 and Standardized value was 0.532. And these showed that the scale had good reliability.

The data showed that the correlation coefficients between each sub-dimension as well as that between each sub-dimension and total score were significant at 0.01 levels. The correlation coefficients between each sub-dimension and total score being higher than those between each sub-dimension indicated that each sub-dimension made a contribution to the total scale and simultaneously each sub-dimension also had certain mutual independence. These showed that the questionnaires had good structural validity.

### **The View about Mathematics Reading Instruction**

What are the views of Mathematics teachers regarding Mathematics Reading? The data showed that 89.0% of the participants thought that reading was important for Mathematics learning. Still, 3.7% of the participants thought that reading was only for learning the Chinese language and English language and Mathematics learning was only for solving Mathematics problems. About 4.9% of the participants considered that mathematical knowledge such as theorems, formulas and samples in Mathematics book should be lectured by teachers and it was unnecessary for students to read them. While 2.4% of the participants thought Mathematics was too difficult for students to read.

### **Teaching Methods regarding Mathematics Reading**

The data indicated that 76.8% of the participants thought that the teaching of reading could improve students' Mathematics learning. About 40.2% of the teachers usually left time for students to read in class. Only 30% of the teachers considered they were very familiar with Mathematics Reading and could use all kinds of methods to guide students' Mathematics Reading, while the others were not familiar with them.

The above results showed that teachers were lacking the theory of Mathematics Reading in teaching. Although they could understand the educational value of Mathematics Reading, they did not know how to teach it.

### **Leave Free Time for Students to Develop Themselves**

The analysis of those from the student questionnaires showed that the scores from public schools were higher than private schools, and the scores of common schools were higher than those from key middle schools. Researchers conducted a special interview addressing this matter. The result was that students from public schools and common schools had more free time than those from private schools and key schools. The most obvious reason for this is that evening classes provide special scheduled time for students to study by themselves. Generally, the students of public schools begin to attend the evening classes from Grade 9 while those of private schools and key schools begin from Grade 7. The length of evening classes' time in private and key middle schools is significantly longer than the general public ones. Also students' activities are not the same. The students of the general public school are basically going to complete the day's homework, or preview the next day's new lesson, or read their favorite books. While the time of private and key school is completely "controlled" by teachers. This is the main reason why the questionnaire scores decline from Grade 7 to Grade

12.

The teachers' interviews also reflected the situation above. Mr. Gee talked about this in his interview: "The school does not leave free time for students and students have a very full schedule. The teachers always have lectures in the evening classes and sometimes even on Sunday, otherwise the pedagogical tasks can not be finished. It is a Chinese students' major characteristic that they have no free time to read by themselves. Students do not know what to do when teachers do not have a lecture." The survey results of open-ended problems demonstrated the above well.

Only with freedom can students make innovation. For future children, we advocate that schools and teachers should keep free time for students and let them grow freely and characteristically.

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