

Assessment of Mathematics Education in China

Rongbao Tu

Nanjing Normal University, China

Article addressed Chinese mathematics education reform in mathematics assessment: School Work-Based Assessment, Selection-aimed promotion assessment, and Mathematics Contest for Students in Primary and Middle Schools.

Key words: mathematics education reform, mathematics assessment.

According to National Research Council [NRC] (NRC, 1993), the effective assessment should include three components: Involving Significant Mathematics, Enhancing Mathematics Learning and Supporting Good Instructional Practice, and Supporting Every Student's Opportunity to Learn Important Mathematics. This article addresses Chinese mathematics assessment, so that readers reflect on what type and content of Chinese mathematics assessment is.

The main assessment types of Chinese mathematics education include school work-based assessment, selection-aimed promotion assessment and competition-based assessment. School work-based assessment includes routine assessment, period assessment and concluding assessment. These assessments mainly take the forms of closed book tests and closed book examinations.

School Work-based Assessment

Routine Assessment

Routine Assessment refers to the students' every day homework.

Routine Assessment usually takes place in the same class or on the exact day of the new knowledge learning with the aim of evaluating the students' mastery of the tasks, arousing their attention into the effects of studying and helping the teachers to diagnose their own teaching gains and losses and the students' difficulties in studying.

Therefore, it is a typical formative school work-based assessment and it mainly takes the two forms of class work and homework.

Class work. Class work is usually carried out during the classroom teaching process. It requires students to answer the questions orally, to write them in the exercise book or on the blackboard, or accomplish the tasks by manual operation.

The main materials of the class work are exercises in the textbook, exercises in the matched exercise book, and exercises made by the teachers themselves.

Primary school students usually have much of this kind of work which occupies half of each class (about 20 to 30 minutes) while middle school students have less of that which occupies less than half of a class (about 10 to 20 minutes).

Homework. Homework is usually done after school and it has the following forms:

- (1) the students write their work in the exercise book;
- (2) the students fulfill the tasks by manual operation, such as small-scaled designs or activities;
- (3) the students carry out a simple research program using the mathematical methods to analyze and resolve the problems in the mathematical study and in ordinary life.

The materials of homework are the same as those of class work. They are mainly based on the study contents of that day and assist with some recent contents studied.

Primary school students usually have a small amount of this kind of work which lasts about 20 to 30 minutes while junior high school students have a little more of that which lasts about 30 to 50 minutes and senior high school ones have much more of this type of work which lasts about 50 to 70 minutes.

Period Assessment

Period assessment is to evaluate students' academic performance at the end of a teaching period; the main aim is to check whether the students accomplish the learning tasks during this period. It intends to not only help students focus attention on their own learning, but also to assist teachers in diagnosing the students' learning difficulties and find out the merits and demerits of their teaching.

Period assessment has many forms, such as tests of teaching units and mid-term examinations. Usually different schools use different ways of period assessment. Nowadays, there are monthly tests, bi-monthly tests and even weekly tests, which go through every semester. Therefore, it is a typical kind of formative evaluation.

In period assessment, closed book exams are usually in written form. The setting of the questions and the tests are organized by schools. There are three types of questions: multiple choice, blank-filling and solution-seeking questions. The quantity of the questions in primary school for this kind of test for pupils is between 45 and 60 minutes while for middle school students it is restricted to between 90 and 120 minutes. The questions in the tests are mainly adapted from examples and exercise in the textbook, some exercises in the

corresponding exercise books and some questions in the entrance examinations.

Concluding Assessment

A concluding assessment is mainly to assess students' achievement. Exams are given to check the mastery of textbook knowledge and its application. Based on the scores of the exams, teachers grade students' levels of accomplishment. The grades of the concluding assessments are recorded in the students' achievement book.

Concluding assessments in elementary schools and middle schools are commonly made at the end of a semester (4.5 months), an academic year (2 semesters) and an academic period (6 academic years in elementary schools and 3 academic years in junior and senior middle schools). Exams at the end of an academic period are also called graduation examinations.

Closed book exams in written form are the only type of tests in a concluding assessment. The test time is usually 120 minutes. There are altogether 20-25 test questions, including 10-12 multiple choice questions, 4-6 pieces of blank-filling and 5-6 pieces of solution-seeking or demonstrating questions.

Exams at the end of junior middle school (Graduation Examination of Junior Middle School) and senior middle school (Graduation Examination of Senior Middle School) are organized by the local administrative department of education. All the other tests of concluding assessment are organized by schools.

Selection-aimed Promotion Assessment

Selection-aimed promotion assessment, which is in part of the concluding assessment, is an important basis of selecting students to go into a higher school.

Since compulsory education was put in practice in China 30 years ago, the Junior Middle School Entrance Examination has been canceled, as has the selecting rule according to examination grades. Children of the right age attend schools near their home, so all of them enter junior middle school. Therefore, selection examinations mainly contain the Senior Middle School Entrance Examination and College Entrance Examination.

“The Mathematics Graduation Examination of the Ninth Grade” (or “Senior high school entrance examination”) is called “O'level” in Britain.

“College Entrance Examination” is called “A'level” in Britain, and is called SAT & ACT in America.

These two examinations in China are organized (propositioned and corrected) by the national and provincial educational administrative departments in charge. These kinds of examinations are organized strictly. The members of the proposition group are mathematics specialists and middle

school teachers with rich teaching experience. During the process of the proposition, they are not allowed to make contact with the outside world until the examinations are over. Based on this strict secret system, we can assure that the selective examinations are carried out under a fair and impartial condition.

Senior High School Entrance Examination (Mathematics)

The purpose and function of senior high school entrance examination (Mathematics). Senior high school entrance examination (Mathematics) in China is a screening test used to choose qualified junior middle school graduates for senior high school.

The examination paper is generally divided into two parts.

The first part is a summary examination, testing the students' scholastic achievements in the stage of compulsory education, with the purpose to evaluate whether the students have reached the qualified level of graduation.

The second part is a screening test for the senior high school to select students. The examination result will directly decide what kind of school the students would enter.

The characteristic of mathematics examination paper for senior high school entrance examination. The setting of exam questions of the mathematics exam in senior high school entrance examination is based on "the course standard for mathematics of junior middle school," framed by national ministry of education, "directions for all the courses in senior high school entrance examination," promulgated by the local educational departments and other related teaching demands. The duration of mathematics examination is 120 minutes, while the total score is 120 points.

The number of exam questions in this exam is 20 to 25. The style of the exam paper is similar, including multiple-choice, filling-blank, short answer, and problem solving. The score proportion among different kinds of questions: Multiple-choice question and filling-blank to question answering and question proving are 4:6.

The degree of difficulty in the exam is between 0.60 and 0.75. The proportion of the questions, questions easy to answer, questions with medium degree of difficulty and difficult question, is 7:2:1.

The mathematics examination of senior high school entrance examination is marked together by the marking group organized by local educational departments.

College entrance examination (Mathematics)

The purpose and function of college entrance examination (Mathematics). The "college entrance examination (Mathematics)" in China is a screening test, which is held to choose freshmen for universities. The people

who take part in the college entrance examination are qualified graduates from senior high school and the examinees with the same educational level.

The college entrance examination is an educational examination as well as a social examination, which has the most far-reaching effect in China.

The setting of exam questions of college entrance examination in China was organized by the National Ministry of Education before 2004. Since 2004, some provinces and cities began to set the exam questions by themselves. Until now, the number has reached 15.

Features of mathematics test paper for College Entrance Examination. Mathematics Test Paper for College Entrance Examination is designed according to *Mathematics Course Standards for Senior Middle School* and *Instructions for College Entrance Examination* and the corresponding teaching requirements formulated by National Education Department.

The time limit of Mathematics Test Paper for College Entrance Examination is 120 minutes, and the full mark is 150 marks.

There are altogether 20 to 25 items in the Mathematics Test Paper, including multiple choices, filling-blank, problem-solving, and reasoning. The ratio of (multiple choice and filling-blank): (problem-solving and reasoning) is 7:8

As to the degree of difficulty, there are three levels of items: Easy (score rate >0.7), moderate ($0.4 < \text{score rate} < 0.7$), and difficult (score ratio <0.4). The score rate is above 0.7. The ratio is: easy: moderate: difficult=3:5:2. The average score rate of the whole Mathematics Test Paper is about 0.6.

Grading of mathematics test paper for College Entrance Examination. Grading of Mathematics Test paper is conducted by the mathematics grading team organized by the Provincial Education Department.

The proportion between the graders and the examinees are 1.2:1000. Take the 2007 mathematics grading work as an example, about 500,000 examinees and about 600 college teachers, middle school teachers and graduate students of the Mathematics Department. There is a preliminary grading by sampling to formulate the grading standards for different answers of each item. The formal grading begins after the two-day training for graders and the preliminary grading. The grading work can be finished within about 10 days.

Grading of the multiple choice items are operated by computers. Filling-blank and problem-solving items are evaluated on-line by graders with computers. Each grader is responsible for only one item which eventually is to be graded at least twice by different graders. Then all the test papers are reexamined by sampling to reduce the maximum 2-score error to the ratio of 0.1‰.

Mathematics Contest for Students in Primary and Middle Schools

As a supplement of the elementary education in mathematics as well as an extracurricular activity in mathematics, the Mathematics Contest in China has become the “Second Classroom” for mathematics study. It aims at enhancing students’ interest in mathematics study, developing students’ intelligence, discovering and fostering mathematics talents, and promoting the universal education of mathematics.

There are various kinds of mathematics contests for students in primary and middle schools, which are usually organized by various academic communities. Few of them are approved by government administrations as a reference for entering schools of a higher grade.

Mathematics contests for students in primary and middle schools include: mathematics contest for primary school students, mathematics contest for junior middle school students, mathematics contest for senior middle school students, and mathematical contest in modeling. Each category has contests of school level, regional level, and national level. Some contests have preliminary contests and final contests. Mathematical contest in modeling is exclusively held in few cities like Beijing, Shanghai, and Guangzhou.

Mathematics contests mainly take the form of solving mathematics problems, including multiple-choice, filling-blank, graph-making, and problem-solving. The items in the contest are interesting, scientific, explorative, and creative.

Students who rank high in the National Mathematics Contest for Senior Middle School Students could obtain the qualification for enrolling in famous universities without taking the National College Entrance Examination. The contests of different levels and categories attract a large number of students, which has developed into a cultural phenomenon in China.

References

National Research Council. (1993). *Measuring what counts: A conceptual guide for mathematics assessment*. Washington, DC: National Academy Press.

Author:

Rongbao Tu

Nanjing Normal University, China

Email: rbtu304@hotmail.com