National Presentation of Korea

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Introduction

Korea, as represented by the Korea Institute for Curriculum and Evaluation (KICE), is pleased to present a National Presentation at ICME-12. We think this is a precious opportunity where we can introduce the mathematics education in Korea. Following an overview of the mathematics education in Korea, we plan to present the policies and many efforts we devote to improve our mathematics education.

Presentations (Two Sessions)

Session I (80-min Session)

1. Overview of Mathematics education in Korea
2. The National Mathematics Curriculum of Korea
3. The Development and Characteristics of Korean Mathematics Textbooks
4. Teaching and Learning practices of mathematics classroom in Korea
5. The educational practices for the Mathematically-gifted and the underachieving students

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Session II (70 min Session)

6. National Assessment of Educational Achievement
7. College Scholastic Ability Test (CSAT) in Korea
8. Achievement on International Assessment in Korea
9. Mathematics Assessment at school level
10. Mathematics Teacher Education in Korea

Overview of Mathematics Education in Korea

Here we provide an overview of the mathematics education in Korea that consists of five areas: mathematics curriculum, textbooks, teaching and learning, educational evaluation, and teachers' education. First, we introduce the national curriculum of mathematics and the revision that has been made throughout the history of curriculum. Second, we introduce the mathematics textbooks that are used at each school level. Third, various types of elementary and secondary classroom mathematics teaching will be reviewed. Fourth, we discuss the three kinds of mathematics assessment: National Assessment of Educational Achievement (NAEA), College Scholastic Aptitude Test (CSAT), and international student assessments. Korea has been one of the top performing countries in students' mathematics achievement in the international assessment such as PISA and TIMSS. Behind its shining accomplishments, the mathematics education in Korea also has some noticeable afflictions which remain for us to resolve. Here we attempt to obtain constructive advice from other countries on our difficulties and problems both in theoretical and in practical perspectives.

The National Mathematics Curriculum of Korea

Korea has a national curriculum system. After the curriculum is announced at the national level, the writers of textbooks begin to develop textbooks on the basis of the national curriculum. Once the development of textbooks is completed, new curriculum is implemented in the school. It takes about 2 years to apply the newly announced national curriculum to the school. The new curriculum is sequentially applied from the 1st grade.

It was 1954 that the mathematics curriculum at the national level was first announced in Korea. Since then, the national curriculum has been revised 8 times. The 7th curriculum was announced by public notification in 1997. Then in 2007 and 2009 revisions were made to respond to rapidly changing external environment in recent decades in Korea.

The latest mathematics curriculum emphasizes mathematical creativity designed to equip students with capacities on basic learning ability, divergent thinking ability, problem-solving ability, originality, and ability to create new values. It also

reinforces mathematical process including problem-solving ability, reasoning ability, and communication ability. To facilitate creative class activities, it was organized to reduce more than 20 % of the existing mathematics contents, and to apply ‘the grade cluster system’ to enhance connection and cooperation between grades.

The Development and Characteristics of Korean Mathematics Textbooks

Mathematics textbooks in the elementary, middle and high schools are being developed based on the curriculum. Some materials suggested here are still under development, which will give us a general picture about the mathematics textbooks in Korea. In Korea, three different kinds of textbooks are used in schools: (1) Government-copyrighted textbooks, (2) government-authorized textbooks, and (3) government-approved textbooks.

Elementary school mathematics textbooks are government-copyrighted textbooks, which are developed by the institute commissioned by the government. Secondary school mathematics textbooks are government-authorized textbooks and government-approved textbooks, which are published through the authorization procedure to guarantee high quality textbooks. In addition to textbooks, student workbooks and teacher guidebooks are developed. Student workbooks are to help students’ self studies and teacher guidebooks are to help teachers apply various teaching methods and guarantee quality teaching.

Teaching and Learning Practices of Mathematics Classroom in Korea

Here we investigate the teaching and learning practices that are implemented in the mathematics classrooms in Korea. Various types of teaching practices in the elementary and secondary classrooms will be reviewed. At the elementary level, we investigate the factors of similarities and differences of the teaching and learning across mathematics classrooms. Also, we explore the general characteristics of mathematics classrooms such as activity-based lessons, emphasis on cooperative learning and communication. At the secondary level, we find the characteristics of mathematics classrooms such as differentiated lessons, subject-based classroom system, preparation for university entrance exam, and the cases of teaching practices. We provide some example cases for a better understanding of the teaching and learning practices at each level.

The Educational Practices for the Mathematically-Gifted and the Underachieving Students

In this section, we investigate mathematics education for the gifted and the underachieving students in Korea. We will describe mathematics educational

systems, contents, and plans of actions focused on these particular students. First, for the mathematically-gifted students, we will introduce the development of various policies and explain three types of institutions for the gifted: schools, education centers, and classes. Additionally we introduce several gifted education programs that are implemented at the elementary and secondary level schools. Second, for the mathematically underachieving students, we will explain various new policies implemented after 2009 where the government, local offices of education, and schools actively participating in supporting underachieving students. Additionally, we will introduce the institutions and programs for the underachieving and the Internet website, called Ku-Cu (www.basics.re.kr), which is operated by KICE to support education for the children with underachievement.

National Assessment of Educational Achievement

The major aims of the National Assessment of Educational Achievement (NAEA), targeted for all schools in Korea, are to (1) acquire information and implications on directions to improve curriculum, teaching, and learning methods, (2) review the educational quality, (3) diagnose and remedy each student's performance level, and (4) examine educational accountability of school education. The NAEA is implemented targeting sixth-grade elementary school students, third-grade (9th) middle school students, and second-grade (11th) high school students across the nation. Test items of the NAEA are developed in contents and behaviour areas based on the national curriculum. Here we describe in depth the NAEA such as the structure, testing time, development of assessment tool, domains of assessment, and the scoring and reporting results. We also discuss the recent trend of the assessment results.

College Scholastic Ability Test (CSAT) in Korea

In this section, we discuss the College Scholastic Ability Test (CSAT). The CSAT has been implemented since 1994, and it was adapted with the changes of the national curriculum and college recruitment systems. The current CSAT for mathematics consists of Mathematics 'GA' (Korean) type and Mathematics 'NA' (Korean) type. Students who will major in mathematics and natural science at college should take Mathematics 'GA' (Korean) type and other students should take Mathematics 'NA' (Korean) type. Test items are developed to examine students' competencies on calculation, mathematical understanding, reasoning, and problem-solving.

Starting from the 2014 school year, the CSAT will be improved to reflect the aims of the 2009 revised curriculum and reduce the importance of the CSAT in the college admission to enhance the autonomy of each college. The title, Mathematics 'GA' (Korean) type and 'NA' (Korean) type, will be changed to Mathematics A type and B type.

Achievement on International Assessment in Korea

In the international student assessment part, we will analyze the characteristics of Korean students' mathematics achievements revealed in two representative international assessments: PISA and TIMSS. Korea has continuously been ranked among the top performing countries in PISA and TIMSS, which has been the result of more students with a high level of proficiency and less students with the lowest levels of proficiency compared with other countries. More than 2/3 of Korean students have performed at the excellent level, and 98 % of them have performed above the basic level. The proportions of Korean students with the highest level of proficiency in PISA and TIMSS, however, have been decreased, which requires policy measures to deal with the situation. We also find further implications from the test results.

Mathematics Assessment at School Level

The evaluation at the school level is administered according to the curriculum. Mathematics assessment at the school level is distinguished by the student's grade. We start with introducing the principles of assessment, the types of assessments and schedule, and the assessment methods. Usually, there are diagnostic assessments at the beginning of school year, scheduled examinations such as mid-terms and final exams at the single school level and performance assessment and quizzes at the class level. Even though the national curriculum strongly recommends various assessment methods, selection type focusing on multiple choice items and constructed-response type problems focusing on short-answer types are in the majority. However, constructed-response items that require the students to create their own answer have also been treated in fair proportion and are applied to not only scheduled examinations, but also performance assessments and diagnostic assessments. We further provide information about the analysing, reporting, and application of the assessment results.

Mathematics Teacher Education in Korea

Here we will discuss about pre-service teacher education, the teacher employment test and professional development of teachers. First, we will review the curriculum of various teacher education programs for the elementary and secondary level prospective teachers in Korea, which features a strong zeal for education. We will also examine the teacher employment test including the procedure, structure, and test areas for the elementary and secondary level.

In addition, we will discuss various teacher professional development programs which are implemented by the 16 metropolitan/local education offices. Typical professional development programs include the pre-employment training program, the 'first-level teacher' training program for teachers with more than 3 years of

teaching experiences, and various in-service training programs. We will also explain the master teacher system, teaching consulting programs, and the classroom assessment system, which are designed to develop teachers' professionalism.

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