

7. Study on the Competencies to be Cultivated through
Mathematics Education and their Classification
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(1) Purpose and Aim of Study

This study involves empirical investigation of the competencies to be cultivated through the school mathematics curriculum in Japan and the classification of those competencies, with the aim of making proposals concerning competencies and their classification in relation to the configuration of teaching content in the area of mathematics.

There are three aspects to the research conducted. The first involves identifying the ways in which individuals engaged in mathematics education conceive the competencies to be cultivated in mathematics. The second entails comprehending the competencies specified in mathematics curricula in countries other than Japan. The third aspect of the study is to identify the mathematical ability being acquired by schoolchildren through actual teaching practice in mathematics. Research across these three aspects will enable proposals to be made concerning competencies and their classification in relation to the configuration of teaching content in the area of mathematics in Japan.

(2) Outline of Research Results

Over the two fiscal years 2005 and 2006, research was conducted across many topics with the aim of developing a structured conception of “mathematical ability.” The principal outcomes of this research are outlined below.

- Firstly, analysis was conducted on approaches to mathematics, activities in mathematics, problem-solving abilities, mathematical abilities, and other factors as revealed in the educational philosophy, curriculum, and examination syllabus in mathematics in Japan and other countries, from the perspective of competencies cultivated in school mathematics. This revealed that the “mathematical way of thinking” that emerged in the school curriculum in the period around 1955 to 1965 and is now the primary

objective of mathematics education in Japan was originally conceived from the perspective of “creating mathematics”—applying mathematical knowledge to solving problems. In this sense the concept of cultivating mathematical problem-solving skills and communicative skills, as emphasized recently in other countries, is weak in Japan.

- Secondly, examination from the perspective of cultivating competencies revealed that recent mathematics curricula refer to a small number of competencies such as computational skills, but make little mention of other kinds of competencies. As a whole, there is an overwhelming emphasis on the comprehension of mathematical concepts.

- Thirdly, a structured conception of “mathematical ability” was developed in light of the educational philosophy, curriculum, and examination syllabus in mathematics in Japan and other countries. The basic approach used was to take into account both the essential nature of mathematics and its social necessity when identifying mathematical ability. A structure was proposed comprising the following four major pillars: (1) the ability to create mathematics (apply mathematical knowledge to solving problems), (2) the ability to use mathematics, (3) the ability to express mathematics, and (4) the ability to think communally through mathematics.

- Fourthly, the content of each of these abilities was explained in detail, standards developed for them, and examples given of initiatives for cultivating them at each year level and school type. The actual status of mathematical ability among elementary and lower secondary school students was also ascertained on a case study basis using the class studies method.

- Fifthly, to inform approaches to the mathematics curriculum in schools, proposals were made concerning a basic model for content choice and configuration, and a curriculum incorporating the concept of mathematical ability.