

EXECUTIVE SUMMARY

There has been an increasing concern about the mathematics education in the school system against the structural changes in the Hong Kong society. The former CDC¹ therefore set up an Ad hoc Committee to conduct a holistic review on the mathematics curriculum in July 1997 to examine the related issues and to make recommendations on the way forward.

To help the Ad hoc Committee to make recommendations to CDC at the end of 1999, two supportive research studies were respectively commissioned to the University of Hong Kong and the Chinese University of Hong Kong in 1998. The two studies were “Comparative Studies of the Mathematics Curricula of Major Asian and Western Countries” and “An Analysis of the Views of Various Sectors on the Mathematics Curriculum”. The two studies were completed with reports compiled in mid-1999. Two press briefings were arranged on 16 December 1998 and 28 June 1999 respectively to publicize the progress of the holistic review of the mathematics curriculum and disseminate the findings from the two studies.

The Ad hoc Committee totally held 22 meetings from July 1997 to December 1999 and worked out 10 position statements to consolidate its viewpoints on major issues related to mathematics education. The statements served as a basis for exchanging ideas between the Ad hoc Committee and the relevant CDC subject committees. The position statements were reviewed and revised in the light of comments received. Eventually, these statements are incorporated into the Ad hoc Committee's final report. Issues addressed in the report are summarized in the following paragraphs.

Mathematics and the School Curriculum

The Ad hoc Committee has summarized the importance and significance of mathematics education in the context of a dynamically changing environment. Mathematics is essential for everyone to become a responsible citizen of the modern age; a knowledgeable or skillful worker in all walks of life; or an expert or a professional of a particular field. The general aims of mathematics education are to develop our youngsters' knowledge, skills, concepts, confidence and interest in mathematics to enable them to master mathematics, and more importantly to further develop related core competence, such as numeracy and logical reasoning throughout their lifetime. The Ad hoc Committee proposes that the curriculum content of the primary and secondary mathematics curricula should be developed to materialize their specific aims. Explicit statements for various aspects of the specific aims at the sixth form level and in each mathematics subject should be developed with reference to

¹ The CDC has been re-structured in September 1999.

those of the primary and secondary mathematics curricula. This will help to form a holistic view of what mathematics education is and how mathematics education can contribute towards the aims of the school curriculum.

Learning Dimensions in the Mathematics Curriculum

The Ad hoc Committee considers that the mathematics curriculum should be designed according to a set of content-based learning dimensions so that learning objectives and students' progress can be structured and represented systematically from primary through secondary level. Mathematics learning should progress from concrete to abstract. Students need adequate prior experience with concrete objects before formal treatment of mathematical concepts. The progression within different dimensions is arranged so that pre-requisite knowledge is sufficiently tackled. High order thinking skills should be incorporated with the content-based learning dimensions to form a reference grid in designing the future mathematics curriculum.

Cross-level Interface in the Mathematics Curriculum

The adopting of a formal treatment in teaching mathematics in some kindergartens has resulted in a continuity problem for students upon admission to Primary 1 as kindergarten learning is not assumed in the development of the primary mathematics curriculum. Some of the materials at Primary 5 & 6 and Secondary 1 are found overlapped. The poor continuation between Additional Mathematics and Advanced level Pure Mathematics and Advanced Supplementary level Mathematics & Statistics is also a concern to most senior level secondary teachers. The Ad hoc Committee therefore recommends that the mathematics curriculum at various levels of schooling should be smoothed to ensure coherence and continuity of the curriculum. To achieve the purpose, the mathematics learning at the kindergarten level should be activity-based, intuitive and simple while that in the primary and secondary schooling should be considered as an entity and should progress from concrete to abstract. The teaching of abstract mathematical ideas should be supported by students' concrete experiences at earlier stages as far as possible and teaching strategies should be progressively changed through different levels of schooling so as to cope with students' development. The mathematics curriculum across different levels of learning should be duly adjusted to suit the different abilities of students. The interflow between primary and secondary mathematics teachers should also be enhanced.

Mathematics for Early Childhood Education

The introduction of mathematics in the early childhood education is to help children enrich and supplement their informal mathematical experience in a meaningful way. It provides children with an opportunity to expose themselves to the experience of learning mathematics through various kinds of mathematical activities. It also gives children an opportunity to develop their abilities to apply mathematical concepts and skills in daily life

situations. Since children at the pre-primary level are only expected to acquire basic skills and concepts in mathematics, the Ad hoc Committee holds that they should not be formally assessed and no prerequisite academic knowledge should be expected of them on their admission to Primary 1. Heuristic methods of teaching should be adopted to help children develop an interest in mathematics learning. Thematic approach with integrated activities of learning should be used for the purpose of flexible curriculum integration.

Mathematics Curriculum for Post-Basic Education

For equality of access and reducing the labeling effect, the Ad hoc Committee does not agree to have curriculum differentiation in the years of general education. Mathematics should be a subject studied by all students. The curriculum should consist of foundation and non-foundation parts like the Secondary Mathematics Syllabus (1999) to cater for learner differences. At the upper end of the secondary schooling, different mathematics subjects, which may come from different combinations of modules and papers, could be developed to cater for the diversified needs of students. The Ad hoc Committee does not agree to stream students at an early age. On the other hand, opportunities for taking mathematics at the upper end of the secondary schooling should be allowed for all students.

Schedule of Implementation of the Mathematics Curriculum at the Primary and Secondary Levels

As the primary and secondary mathematics syllabuses were under revision during the process of review, the Ad hoc Committee also scrutinized the revisions critically. The Ad hoc Committee agrees to have the finalization of the revised primary mathematics syllabus in August 2000 so that the Ad hoc Committee's recommendations can be incorporated in the syllabus as far as possible. In this connection, the earliest implementation date of the revised syllabus will be deferred to September 2002. However, in the meantime, teaching materials on development of number and spatial sense and use of Information Technology (IT) in primary mathematics should be published to keep teachers of primary schools informed of the recent development of mathematics education. For the revised secondary mathematics syllabus, the Ad hoc Committee accepts that the major concerns, such as learning dimensions, catering for learning differences, enhancing of high order thinking skills and use of IT in mathematics, have been incorporated in the revised syllabus. The revised secondary mathematics syllabus was finalized in July 1999 and will be implemented at Secondary 1 in September 2001. The syllabus will then be reviewed together with the primary mathematics syllabus, if necessary, after considering the Ad hoc Committee's recommendations.

Assessment in the Mathematics Curriculum

The Ad hoc Committee accepts that assessment should be an integral part of the teaching-learning cycle. Assessment should play an important role in providing feedback for improvement in teaching and learning. Assessment of students' performance may take

many forms and should be integrated with other classroom activities. It is agreed that the design of learning objectives, learning activities and assessment tasks should be aligned to ensure that what is intended will be properly taught and successfully learned. The possibility of setting minimal competence for mathematics at various stages of schooling should be explored. The Ad hoc Committee also considers that assessment for high-stake purposes (such as placement and selection) should be played down so that interruption to normal teaching and learning in schools can be minimized.

Catering for Learner Differences

Learner differences are inevitable as different students have different sets of developed intelligence, abilities and educational experience. In spite of the difficulties teachers face in school, like crowded classroom and packed curriculum, the Ad hoc Committee holds that suitable measures could be taken to reduce the effect brought about by the learner differences of students. In addition, equal attention should be placed on both lower academic achievers and more able students. In the curriculum aspect, a flexible curriculum embracing foundation and non-foundation parts and enrichment content is a possible measure. Apart from the flexibility elements in the mathematics curriculum at the primary and secondary levels, curriculum differentiation at the upper end of the secondary schooling can be considered to cater for students' different needs. In the school aspect, schools can adopt organizational arrangements like ability grouping in catering for the learner differences. Mathematics-related activities are also good means to cultivate the interest of students. In the classroom aspect, curriculum adaptation, relevant and realistic contextual tasks, and active and purposeful learning activities that allows individualized ways in the construction of knowledge are helpful. Since the success of these measures relies on teachers' professional judgement, competent teachers are required to deal with the different mathematics abilities of students. In the assessment aspect, more emphasis should be laid on the assessment of minimal competence instead of the unnecessarily complicated problems. Moreover, a wide range of assessment activities is recommended for getting adequate information to organize students' learning experiences.

Quality of Mathematics Teachers

The Ad hoc Committee is very concerned about the training of mathematics teachers. Effective implementation of the mathematics curriculum relies very much on the supply of knowledgeable and well-prepared teachers who are able to put the ideas of the mathematics curriculum into practice and realize the benefits as stated in the mathematics syllabuses. A good mastery of teaching methods as well as a strong mathematical background are important traits for a mathematics teacher. It is advisable to strengthen the subject specific component in Bachelor of Education courses. On the other hand, training of teaching methods should be provided to practising teachers with degrees in mathematics or related disciplines. The Ad hoc Committee generally agrees that an ideal qualification for a mathematics teacher, in the long run, is a bachelor's degree in mathematics or related discipline together with

Postgraduate Diploma in Education or Postgraduate Certificate of Education. Mathematics teachers should see the importance of life-long education for teachers. Collegiate exchange among mathematics teachers should be encouraged.

Using IT in Mathematics Education

The Ad hoc Committee has examined the use of IT in teaching and learning mathematics and agrees that using IT in teaching and learning mathematics may bring about many benefits. IT can be used to enhance and extend mathematics learning experiences. Using IT in learning mathematics should encourage active student participation in exploratory and investigative activities. The future mathematics curriculum should focus on the effective use of information for problem solving - one of the principal reasons for studying mathematics. The Ad hoc Committee stresses that mathematics should be taught in its own right and with its own educational objectives for the information age. The Ad hoc Committee also realizes that IT should be cautiously used in classrooms. Teachers should act professionally towards choosing the most appropriate educational technology to benefit their students.