

## **DG 4: Reconceptualising the mathematics curriculum**

Team Chairs: Jane Schielack, Texas A&M University, USA, [janie@science.tamu.edu](mailto:janie@science.tamu.edu)  
Yeping Li, Texas A&M University, USA, [yepingli@yahoo.com](mailto:yepingli@yahoo.com)  
Team Members: Henrique Guimarães, University of Lisbon, Portugal  
Tomas Højgaard, Aarhus University, Denmark  
Hanène Abrougui, Tunis University, Tunisia

### **1. Introduction**

Mathematics curriculum, as a system and cultural artifact, is developed and typically used to outline teaching and learning requirements in content and performance. Efforts to improve student mathematics learning in many education systems often take curriculum reform as a starting point for changes (e.g., Leung & Li, 2010; NCTM, 2000). As students' learning of school mathematics is perceived as a way to empower all students mathematically, descriptions of students' learning outcomes through school education are thus increasingly used in conceptualizing school mathematics in ways that are different from traditional mathematics curriculum. The changing nature of mathematics curriculum in various education systems prompted the creation and organization of DG 4 for interested mathematics educators from all over the world in the congress.

The entire organising team worked together before the congress in planning and organising DG 4. As Hanène Abrougui was unable to attend the congress, the DG organisation at the congress was taken care of by the two chairs and the two team members present. The DG 4 was well-attended over all three sessions, which indicates the interest in mathematics curriculum by congress delegates. This report provides an overview of the aim and focus of DG 4 and a summary of the discussion that occurred throughout the sessions.

### **2. Aim and Focus**

As set by the organising team, the general aim of DG 4 was, in the international mathematics education community, to increase the awareness of the changing nature of mathematics curriculum around the world, to promote exchange and collaborations in the (re-)conceptualisation and policy research in developing intended curriculum, and hence to raise the level of research and development of mathematics curricula that are originated in different systems and social-cultural contexts. More specifically, through its official programme during the congress and other activities (including those before and after the congress), DG 4 was intended to provide an international forum for all interested parties (for example, mathematics education researchers, curriculum specialists, curriculum policy makers, and school teachers, etc) to:

- share information about current or planned reconceptualisation efforts that are underway and the relevant issues that have arisen in relation to these efforts, and
- produce a summary of the critical issues surrounding mathematics curriculum reconceptualisation.

There are a wide range of possible issues that could have been addressed in this discussion group. In particular, the organising team highlighted some notions that are commonly used in mathematics curriculum, such as numeracy, mathematical literacy, mathematical competencies, mathematical proficiency, and core curriculum. The use of such notions shows a departure from traditional concepts of the mathematics curriculum based on mathematical topics. Mathematics curriculum is thus conceptualised not as a list of mathematics topics to be taught, but more as specifications of what students are expected to know and be able to do as a result of mathematics learning. Inevitably, such changes present opportunities as well as difficulties for improving mathematics education. To direct potential contributions to DG 4, the organising team developed a call for brief papers that articulated issues or dilemmas

that could help set context for discussion in the congress. Specifically, the organising team proposed to address the following broad questions:

- What are the differences between the various notions of reconceptualisation of the mathematics curriculum?
- What are the advantages and the drawbacks of such approaches in comparison with topics-based approaches?

A writer could choose to focus on one particular aspect of mathematics curriculum reconceptualisation, such as the description of mathematical proficiency, or on the process of reconceptualising the mathematics curriculum, or some combination of related and relevant topics. In order to stimulate discussion, the team solicited and encouraged the submissions to provide information on curriculum practices across a range of contexts and with varied perspectives from different education systems.

### **3. Session 1: Identifying and sharing the different notions of reconceptualisation of the mathematics curriculum practised in different systems**

The first session of DG 4 provided an opportunity for participants to present their theoretical bases for reconceptualisation of the mathematics curriculum. Based on the papers submitted before the congress, the presentations were sorted into two categories—those that addressed mathematical literacy in general and those that addressed specific national cases of curriculum change. Members of DG 4 prepared to discuss advantages and drawbacks to the different notions of reconceptualisation in Session 2 after listening to the following papers presented during Session 1.

#### ***3.1 Mathematical literacy***

Members of DG 4 heard presentations of three papers addressing a general perspective of mathematical literacy as a basis for reconceptualisation of the mathematics curriculum.

##### *3.1.1 What is mathematical literacy?*

In this paper, Tony Gardiner (University of Birmingham) argued for a consideration of mathematical literacy, or “numeracy,” as a by-product of effective mathematics instruction rather than as its central goal. He proposed a definition of mathematical literacy as “a subtle, long-term aspiration involving important insights into the nature of elementary mathematics and its utility.”

##### *3.1.2 Some (persistent) tensions on curricular change*

Henrique Manuel Guimarães (University of Lisbon) provided a collection of spectra across which to consider curricular change. These spectra included the following perspectives: global vs. local; national vs. regional; one level of mathematics for all vs. differentiated levels of mathematics for each; content vs. methodology in teaching; content vs. process in learning; knowledge vs. capacities; understanding vs. rote memorization; conceptual understanding vs. procedural understanding; intuition vs. rigor; and autonomy vs. control.

##### *3.1.3 Conceptualization of school mathematics as situated in a social-cultural context*

In the final paper of this section, Yeping Li, Xiaohong Zhu, and Tingting Ma (Texas A&M University) discussed the reconceptualisation of school mathematics as involving a combination of curriculum formation as a cultural activity and curriculum transformation as a cultural enterprise.

#### ***3.2 National cases in curriculum change***

Members of DG 4 then heard four papers addressing reconceptualisation of the mathematics curriculum from specific national viewpoints.

##### *3.2.1 The concept behind the National Council of Teachers of Mathematics Curriculum Focal Points*

Jane Schielack (Texas A&M University) discussed the NCTM's Curriculum Focal Points as a representation of the next generation of US curriculum documents. For discussion purposes, the Curriculum Focal Points were viewed from two perspectives: the concept of a focal point and the actual content delineated within the focal points at particular grade levels.

### *3.2.2 A reflection on the reconceptualisation of mathematics curriculum for the Nine-Year Compulsory Education in Mainland China*

In this paper, Yun-peng Ma (Northeast Normal University) outlined China's process of reconsidering and reforming Chinese mathematics education, aiming to further improve students' mathematical accomplishment with a special attention to fostering students' creativity and exploration, as well as their attitudes towards mathematics. In the process of reform, conflicts have arisen between mathematics curriculum understanding and mathematics educational value; between basics and development placed in mathematics curriculum; between mathematics curriculum for "public" or for "elite"; and between a focus on basic training and a focus on creative thinking.

### *3.2.3 Key issues in the changing of Portuguese Mathematics Curriculum*

Henrique Manuel Guimarães (University of Lisbon) presented the main purposes of the readjustment of the mathematics curriculum recently conducted in Portugal: to achieve better curricular articulation, clarification, and actualisation. Discussion included the main aims of the readjustment—(a) to promote and develop in the students the information, knowledge and experience in mathematics and their ability to integrate it and use it in varied contexts and (b) to develop positive attitudes towards mathematics and the disposition to value this science—as well as key features, components and guidelines of the new programme.

### *3.2.4 The conceptualisation and research of "New Ideas" Elementary Mathematics Curriculum in China*

In the final paper of this section, Tianxiao Zhang, Reping Zhu, and Caibin Tang, (Hangzhou Education Research Center on Elementary Mathematics) shared their experiences in conceptualising the series of "new ideas" elementary mathematics textbooks, together with the findings from research conducted to investigate its effectiveness.

## **4. Session 2: Discussing advantages and drawbacks to given notions of reconceptualisation of the mathematics curriculum**

In the second session of DG 4, participants decided to have one whole-group discussion rather than to break into smaller groups. The discussion was focused around two themes: (1) dimensions of reconceptualization and (2) influences on reconceptualization. Participants who had not formally submitted a paper were encouraged to contribute additional examples to the discussion.

Dimensions in addition to those highlighted in the formal presentations included the importance of introducing mathematics with difficult problems, as in the Singapore curriculum, and the engagement of various communities in the process of curriculum revision as carried out in Denmark. A critical influence that was further discussed was the relevant research available on curriculum components, such as that from the Netherlands. As might be expected, another critical influence that was added to the discussion was the political importance of local, regional and national assessments.

## **5. Session 3: Summarising and planning**

In their last session, members of DG 4 worked together to create an outline for reporting on the issues related to reconceptualising the mathematics curriculum. A subset of the members of the DG was charged with fleshing out the outline for the dimensions of reconceptualisation, and another subset was charged with addressing a similar task for the influences on

reconceptualisation. All members agreed that the presentations and discussions had broadened their vision of these aspects of reconceptualising the mathematics curriculum.

### **References**

Leung, F. K. S., & Li, Y. (Eds.) (2010). *Reforms and issues in school mathematics in East Asia*. Rotterdam, the Netherland: Sense Publishers.

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