Chapter 15
Introduction

Angel Ruiz

In the pages that follow, we include various experiences or examples mainly from papers and discussions about the implementation of mathematics curriculum reforms in the following countries or regions: Australia, China, Costa Rica, Denmark, France, Hong Kong, Israel, Italy, Japan, Lebanon, Luxembourg, Mexico, the Philippines, Quebec (Canada), South Africa, Spain, Thailand, Tunisia, United Kingdom, Vietnam, Wallonia-Brussels Federation. Most of the cases were collected during the *ICMI Study 24 Conference* on the theme 'Implementation of reformed mathematics curricula within and across different contexts and traditions'.

Diversity

The implementation of mathematics curriculum invokes from the beginning what is very important to underline: the enormous diversity of these processes. To begin with, the implementation depends on the nature of the reform: There are reforms that seek to impact fragments of a few grades or dimensions of the curriculum (something that can be very important) but also, we find reforms that affect profoundly all school levels. Some may affect content, aims and certain teaching approaches; others can invoke drastic significant paradigm changes. Diversity among the reforms is one of the first factors that we find. But there are many more, for example:

The general locus There is context diversity that can be about culture (East–West), or socio-economic conditions (developed or developing). And also, the reform impact may affect different geographical or social endeavours (national, regional).

A. Ruiz (✉)
University of Costa Rica, San José, Costa Rica
e-mail: ruizz.angel@gmail.com

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National political and institutional scenarios There are diverse national institutional features in relation to the education system. For example, curricula can be national, state centralised or not. The structure and influence of government and politics on education can strongly affect the characteristics of a reform (its continuity and support, for example).

General strategies and timeframes The general strategy adopted for the implementation process can generate important differences. For example, if is top-down or bottom-up, or a combination of both. Timeframes (expected) for a reform implementation define different actions. A reform that can be implemented during just a few years is not the same as one that would take one decade, or when the expectation is to have a definitive implementation in a 'generational' time period (during decades).

Influences The reforms can have different combinations of influences that can impact their development: international (twenty-first century abilities, competences, problem solving, STEM, PISA) and local (national constructs, responses).

The situation of educational agents There are different types of teacher preparation, and the characteristics of teacher hiring or professional development systems can be very diverse. The role of education advisers, supervisors and other education officials may be very important for the development of a reform and the role of these agents can be very different. The impact of education and academic associations or even unions within a country may play decisive roles and are different in each context.

These intermingled different conditions play a role in the meanings of a curriculum: 'intended', 'implemented', 'attained. And that multiplicity of scenarios allows us to understand that what in one context may be an insufficient realisation or a failure, in another may be what one can aim for and its realisation represents a success. Every factor can be both an advantage and a constraint when considering the implementation of curriculum reform. For example, on one hand, while a curriculum reform addressing all school levels allows the opportunity for a design with curricular aims developed and connected through many years, it may be too great of a demand on resources to be able to be implemented effectively. On the other hand, a reform addressing only one level of schooling may be the opportunity for teachers to engage in deep professional learning but may be hampered by lack of continuity.

What is the first warning for the reader of this section? Though we try to identify common elements, patterns, local or national models, good practices, or international standards that can provide support to understand the processes of implementation of curricular reforms, we find it prudent not to make many generalisations and extrapolations that could distort the subject. The indications or even lessons that are included in this section and chapters should be covered with that intellectual mantle.

The 'Process' Dimension and the Wider Perspective

Besides diversity, we want to emphasise two more aspects. One is connected to the distinction of curriculum as 'product' or as 'process'. Without a doubt, there is an interplay among 'intended', 'implemented', 'attained' curricula, but in relation to implementation there is a fundamental weight of the agents and strategies involved, and therefore the 'process' dimension is the crucial one. The perceptions and attitudes of these agents, as well as the nature and manner of dealing with implementation strategies, occupy the locus where we seek to investigate what happens according to the diverse experiences that we have. Somehow, this stresses that a curriculum reform should not be considered static, synchronic in all its components or void of historical dynamics: consciously or not, planned or unexpected, many things can change during the 'process' of a reform.

A second aspect: undoubtedly, teachers occupy a privileged place in curriculum implementation as do resources and assessment (we are dedicating one chapter to these), but all these elements, again, play roles that depend a great deal on the nature of the reforms, but essentially on the contexts where they occur. And that raises a crucial issue: It should not be thought that the characteristics and opportunities for the implementation of a reform in the teaching of mathematics depend only within this discipline, it is very common that the timing and fate of the reforms, especially when they are deep transformations, depend on wider social or national variables.

Structure

We have organised our theme through three chapters and a conclusion.

Chapter 16 examines curriculum reforms in Denmark, France, the Philippines, and mainland China in considerable detail. Reforms in Wallonia-Brussels Federation, Tunisia and Quebec (Canada) are discussed in much less detail. In the contributions included, the authors offer elements to answer the first question that guided the theme "Implementation of reformed mathematics curricula within and across different contexts and traditions" of this *ICMI Study*: 'What processes, models, or best/common practices can be identified from the experiences in the implementation of new or reformed school mathematics curricula?' Similarly, the description of the reforms provides a first line of response to the question: 'What are examples of successful or unsuccessful reforms and what are the reasons for their success or failure?' And elements are given on, 'What criteria are used for assessing curriculum reforms and their degree of success or failure?' In this chapter, theoretical or conceptual frameworks are introduced (by M. Artigue and M. Niss) to calibrate the dimensions or general components present in every curricular situation or to understand with more universal categories, the place, interactions, scopes and impacts of the reforms in the educational fabric, social, national or international.

The aim of Chap. 17 is to identify factors that intervene within mathematics curriculum reforms and precisely seek for 'processes, models, or best/common practices' that can be relevant for the progress or success of a reform. To collect elements from diverse contexts (cultural, socio-economical and geographical), which can support our analysis, three cases are introduced first with certain detail: Japan, Thailand and Costa Rica. One of our purposes, to fulfil for all curriculum reforms was to identify visions, values and goals, that may condition curricular reforms and their implementation beyond just a few national scenarios.

Chapter 18 first responds to the fourth question of the *ICMI Study* Discussion Document: "What models or processes for professional teacher preparation and continuous development have been carried out in different countries in the implementation of new or reformed curricula; and what are their influences, effectiveness, successes or failures?" It analyses the factors in their initial preparation and in their professional development that act in the curricular implementation, the interrelation between reform and teachers' action. Secondly, it responds to the fifth question of the cited document: "What are the types of resources and what are their roles (e.g. textbooks, materials, technology) in the implementation of reformed curricula?" Then the participation of the diverse resources is also studied here: material and social, based on technologies or multimedia. The chapter, additionally, points out the role of assessment at the national or international level as a conditioning factor, and at the same time, as a potential instrument in curricular development.

There is no chapter completely dedicated to responding directly to the set of questions, "How is the implementation of new or reformed curricula monitored, evaluated, and acted upon? What are models or mechanisms of continuous improvement in school mathematics curricula? How does the existence of such a mechanism affect the frequency, (dis-)continuity, and perceived challenges and successes of curriculum reforms?" However, some parameters that can serve as a means to gauge the success or progress of a reform are indicated within the first three chapters (especially in Chap. 17).

The conclusion (Chap. 19) seeks to provide a set of 'laws' that emerge from the studies carried out in all the previous chapters. It is not, however, a systematic collection of the results associated with each chapter, it is rather a meta-reflection. It also includes a brief insight on the impact of the pandemic provoked by COVID-19 for the implementation of curriculum reforms.