Part IV
Mathematics Education in Different Epochs and in Different Regions: Modern Period

Introduction

This part is devoted to mathematics education in Modern times. For Western Europe, the French Revolution and the Napoleonic wars make a natural starting point for this period. These events, indeed, transformed not only the system of socioeconomic relations but also the system of education, including, and perhaps even first and foremost, mathematics education. The *École polytechnique*, which was established in Paris on the crest of the French Revolution, became a model for international imitation, while the decrees of Napoleon, a former artillery officer who had studied mathematics seriously, opened up for it a far more respectable place than it had hitherto occupied in school curricula, and not only in France but gradually also in the rest of what was then Europe.

The change in the role of mathematics in education reflected a change in its role in life. The nineteenth and twentieth centuries witnessed a rapid development of science and technology, for which mathematics was indispensable. As the need for mathematics grew, so did the opportunities for teaching it – technology, in the broad sense, acquired an ever broader presence in mathematics classes, from mass-produced textbooks and blackboards to computers and the Internet.

Already in the eighteenth century, enlightened absolutism had begun restructuring the system of school education, taking a more and more active part in its organization: a number of countries witnessed the appearance of the beginnings of a system of government-run schools and government-run teacher preparation. In the nineteenth century (and even more so in the twentieth), such systems began operating far more broadly and comprehensively. The government, naturally, still needed to have qualified personnel prepared for its own operation, but the government's objectives also came to include a broader preparation of educated specialists, including preparation that to some extent provided an opportunity for upward mobility, attracting people from formerly poorly educated sectors of the population (although restrictions based on economic and social status continued to exist and can hardly be said to have disappeared completely even now). The increase in the number of students from mathematics for the few to *mathematics for all* – which took place alongside of changes in the contents of education and teaching

style – is probably the most important aspect in the development of mathematics education in the modern period.

While the contents of mathematics teaching had been restricted during premodern times to some rudiments of arithmetic and of geometry, these contents evolved considerably over this period and came to give students decent access to key concepts and branches of mathematics. Some topics and some approaches became widely used and may be characterized as traditional in mathematics education. As a counterweight to it, the modern period witnessed two waves of reform movements: the first in the late nineteenth and early twentieth centuries, which it is natural to link first and foremost with the name of Felix Klein, and the second from the late 1950s until the early 1970s, which, again with certain qualifications, may be called, using its American name, New Math. Both movements were international, and the emergence of international movements in mathematics education is also one of the distinctive features of the modern period (or more precisely, of its last century), along with the recognition of mathematics education as a field of international scientific research.

The world of the modern period was very heterogeneous – during the nineteenth century, a number of countries established colonial empires; other countries, first and foremost the countries of Europe and North America, were independent, but many others were either colonies or semicolonies, or had only relatively recently become independent. The construction of a system of mathematics education in these countries, far from complete, is also a subject of the present part of the book.

The system of mathematics education in the colonies and semicolonies usually consisted of two parallel subsystems, which virtually did not interact with one another: on the one hand, education for the colonizers and a very small number of representatives of the local elite who were given access to it, and on the other hand, rudimentary education for the rest (or more precisely, for the relatively very few individuals who were given access even to it, since most of the population received no formal education at all). The developmental processes of this system are interesting not least because they vividly expose the socioeconomic and political roots and causes of successes and failures in mathematics education. In addition, in studying these processes, researchers can observe the interaction of different sources of influence within the bounds of the same region – on the one hand, approaches to education, usually informal ones, that are traditional for the given region, and on the other hand, methods introduced from elsewhere, which were themselves varied, if only because during the period of the Cold War, education too became a part of that conflict, and thus local education came to be modeled sometimes on Soviet mathematics education and at other times, say, on American or British education.

Several chapters in this part are devoted to the history of mathematics education in specific countries, which allows their authors to connect the history of mathematics education more closely with the socioeconomic and political history of these nations. Other chapters – sometimes due to the greater interdependence of particular countries and the greater homogeneity of the regions to which they belong and sometimes simply because they have

been studied less and fewer materials about them are available – are devoted to whole regions.

As in the other parts of the book, the temporal borders of the period under examination in this part are not everywhere the same. As has already been said, the traditional periodization of Russian history suggests that the discussion should begin with Peter I and the intensive use of the Western European experience, in other words, 100 years before the French Revolution. In other countries, the period when such reliance on Western European models begins is the second half of the nineteenth century, and consequently, this is the most convenient starting point for the analysis of their mathematics education histories. Sometimes it turns out to be natural to begin even later, as practically no evidence from earlier times has survived. In this way, one can speak only of an approximate frame for the period under examination. On the other hand, the events of modernity, that is, the most recent decades as a whole, are not part of the subject of this book.