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Secondary School Mathematics Curricula

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Mathematics has long been an internationally-accepted subject in school curricula. In most systems between 12 and 15 per cent of student time is devoted to mathematics. Kamens & Benavot (1992) focused on the official primary curricula of mathematics and science in a large number of countries between 1800 and 1986, and showed that by the turn of the 20th century both arithmetic and science were firmly established in most countries. They also showed that national differences in the curricular content of mathematics and science were small, and that key indicators of socio-economic development, economic dependence, or world system position did not correlate much with instructional time. Oldham (1989), after trying to find out whether there was an international secondary mathematics curriculum, stated (p.212) that:

> it can be said that there is indeed an international mathematics curriculum. However, the commonalty is moderated by distinct (and less distinct) patterns of diversity; so a better conclusion is that there are several international curricula, sharing many features but with roots in different mathematical and contextual traditions.

Further examples from the 21st century include international studies such as the Third International Mathematics & Science Study (TIMSS) and the OECD-sponsored Program for International Student Assessment (PISA), which have worked with an assumption of universal mathematics and an international mathematics curriculum (FitzSimons 2002, p.110).

In order to understand the stability and change of school mathematics curriculum, some researchers have adopted a world system perspective by emphasising the influence of Western culture, whereas others have focused on local shaping forces in Western developed countries. Kamens & Benavot (1992) suggested that their above-mentioned findings could be explained by the growing transnational forces and worldwide institutionalised cultural rules originating from Western culture.

In a study of stability and change in the School Mathematics Project (SMP) in the 1960s in the United Kingdom, Cooper (1985) used sociological analysis to investigate the nature of school mathematics as a subject, and the process, nature and control of its redefinition. He identified the sources of innovations and the higher institutional decision-making processes which determined which innovations would be filtered through to schools and other educational institutions.

Related work by Moon (1986) focused on the New Mathematics Movement in France, England & Wales, the Netherlands, West Germany and Denmark from 1960 to

1980. The general pattern identified was that while the universities had a major impact on the reform, the 'high status' of New Mathematics was used, or later abused, by material and ideational interest groups. Moon also argued that commercial publishers were influential in the New Mathematics debate. Similarly, Stanic (1987a, 1987b) studied mathematics education in the USA at the beginning of the 20th century. He noted the decline in the influence of 19th century mental discipline theory and the rapid societal changes brought by industrialisation, urbanisation and immigration. In response, various curriculum interest groups argued for their distinct ideas of selection and organisation of school knowledge. In the field of mathematics, the justification question was not the heart of the issue, but conflict, continuity, and compromise emerged in the struggles and controversies.

In the light of such literature, this chapter compares the stability and change of secondary mathematics curriculum in Hong Kong and Macao. Both worldwide and local shaping forces are examined. Adoption of textbooks before World War II is studied first in order to understand the common origin of the traditional approach to mathematics teaching and learning in Hong Kong and Macao. The Communist threat in the late 1940s and the different reaction of the two colonial governments marked the point of bifurcation – the advent of locally-published textbooks in Hong Kong in the early 1960s. Differences in response to the worldwide Modern Mathematics movement by the local mathematics educators brought further diversity in mathematics curricula. Finally, differences in curriculum development organisations are discussed in relation to the late-colonial and postcolonial challenges including universal free education and advance of information technology. The two territories have a common origin in secondary mathematics curriculum, but they moved into different paths in the early 1960s and remained on different tracks. It is unlikely that these two curriculum tracks will converge in the near future.

This chapter also suggests that in the study of stability and change of school knowledge in non-Western places like Hong Kong and Macao, Western influences on mathematics must be considered but local socio-historical background and efforts by local mathematics educators must also be taken into account. The sociology of educational systems proposed by Archer (1979, 1983, 1993, 2000) provides a useful framework to integrate the study of Western influences and local forces into a coherent and illuminating explanatory analysis.

The Common Origin of Traditional Mathematics

Before the 1960s, the mathematics curricula in Hong Kong and Macao secondary schools were mainly textbook-driven. Schools commonly had separate textbooks and even separate teachers for arithmetic, geometry, algebra, trigonometry, coordinate geometry and calculus. The theoretical root of this approach was established over 300 years ago. The traditional organisation of mathematical content was evident in the division of the subject into four main branches: arithmetic, algebra, geometry and analysis, with each considered as a closed and separate field of investigation (Fehr 1970, p.200).

The most popular traditional mathematics textbooks adopted by the Chinese-medium schools in both territories were Chinese translations of American textbooksof the 1910s (K.C. Tang 1999). The most popular algebra textbook was *College Algebra*