THE PROCESS OF DECOLONIZING SCHOOL MATHEMATICS TEXTBOOKS AND CURRICULA IN THE UNITED STATES

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One commentator on the influence of textbooks on US schooling before 1960 has stated that "old text books in use in any particular place at any particular time largely constituted the course of study of its schools" (Nietz, 1966, p. 1). According to Nietz (1966), before 1850, US teachers were so poorly trained and educated that they were compelled to rely on text books to inform them on what they should teach and how they should teach it. Nietz further claimed that his analysis of old school textbooks not only revealed how the US school curricula had evolved but also, "to some extent, the teaching and learning methods as well" (p. 1). It is received tradition that the type of argument presented by Nietz was particularly relevant to school mathematics.

Commercial Aspects of Mathematics Textbook Publishing

Written from a British perspective, an article "Australia and Van Diemen's Land" (1868) drew attention to the profitability of colonies for the British homeland. The unnamed author stated:

> In Prussia the inhabitants consumed each to the value of 6d, of British manufactures; in Russia 8d; in France 1s, 6d; in the United States 5s, 6d; in Canada 1 pound 15s; in the West Indies 2 pound 17s, 6d; the Cape of Good Hope 3 pound 2s; and in Australia from 7 pounds to 10 pounds. Should the population of these [i.e. Australian] settlements – amounting altogether to about 350,000 – therefore increase during the next half century as it has increased during the last, we may expect an enormous impulse to our industry and consequently a great accession to our general prosperity as a nation. (p. 1468)

Quotations like this reveal the extent to which European colonizing nations looked upon their colonies in terms of profit. One only has to examine carefully the figures in the above quotation – focusing for example on the difference between the values quoted for the United States, Canada, and Australia – to recognize that the loss of the North American colonies after the War of Independence in the late 1770s and early 1780s had a large economic effect on England.

Textbooks were among Great Britain's most profitable exports to the American colonies in the first three quarters of the eighteenth century. For example, there was only one arithmetic text book written in the English language by an American writer before the 1780s, and that book, written by Isaac Greenwood (1729), had a very limited circulation. Arithmetic text books used in North American colonies in the seventeenth and eighteenth centuries had been written in England primarily for students in that country. There was a succession of British texts – including Ward (1707), Hodder (1719), Cocker (1738), and Dilworth (1762) – and no locally written textbook had any chance of being preferred before texts written at "home." As soon as the United States of America was legally constituted, however, the impoverished fledgling nation wanted to avoid expenses associated with importing English arithmetics and to show that, educationally, it was capable of generating texts superior in quality to those from England. In 1788, George Washington wrote a letter to Nicolas Pike commenting on Pike's ground-breaking *A New and Complete System of Arithmetic, Composed for the Use of the Citizens of the United States*:

> It seems to have been conceded, on all hands, that such a system was much wanted. Its merits being established by the approbation of competent judges, I flatter myself that the idea of its being an American production, and the first of the kind which has appeared, will induce every patriotic and liberal character to give it all the countenance and patronage in his power. (Washington to Pike, June 20, 1788)

After tentative beginnings in the late eighteenth century, the process of decolonizing school mathematics textbooks and curricula in the United States gathered momentum in the nineteenth century (Cajori, 1890). As far as we know, 100 years after Pike's book was published, no text book written by an English author was being used in schools in the United States of America. By contrast, in the gold-rich British colony of Victoria, in Australia, no mathematical text book used in the private or government schools was written by an Australian author until Burston's *State School Arithmetic* appeared in 1880. Before 1880, the only mathematics texts used in Australian schools were those written by British authors.

The Standard Sequence of Topics in Early Arithmetic Texts

Around 1200, Leonardo Pisano (known as Leonardo de Pisa), wrote a famous text *Liber Abbaci* which had 15 chapters and set out a sequence of arithmetic topics that would, with occasional extensions, be followed in arithmetic texts for at least the next 600 years (Swetz, 1987). This sequence started with Hindu-Arabic numerals, the four operations on whole numbers, conversions of currencies and measurements, associations and partnerships, profit, barter, simple interest, and metal alloys and mixtures. Like the content sequences in the English arithmetics of Hodder (1719), Cocker (1738), and Dilworth (1762), Pike's (1788) *Arithmetic* followed a similar sequence to that in *Liber Abbaci*. It proceeded from basic arithmetic to business mathematics (including arbitration of exchanges, fellowship, tare and trett, discount, barter, equation of payments, commission, compound interest, and alligation) (Albree, 2002).

The Colonizers and the Colonized

During the early European settlements of American colonies, any mathematics taught in the colonial schools was largely transplanted from the colonizing "homelands." The sequence of topics remained unchanged because it had become part of a tradition within an educated élite, who saw classics (Greek and Latin) as the cornerstone of a first-class education for boys. However, in a world in which navigation, surveying, and business transactions were increasingly important, it became recognized that some students could profitably study mathematics (especially arithmetic and geometry) to the benefit of themselves and the nations in which they lived.

In homeland contexts, the introduction of applied mathematics into institutions like the Royal Mathematical School at Christ's Hospital in London proved to be of great benefit to nations seeking to develop their land and sea power, and to maximize profits through trade. However, in the American colonies, for example, the forms of training for navigation, surveying and trade needed to be appropriate for the specific conditions in the colonies. The texts in the European mathematics books were often inappropriate to the challenging and often qualitatively different contexts and environments in the colonies.

Clements, Grimison and Ellerton (1989) argued that colonialist attitudes usually persist within nations and)cultures long after colonies have gained their independence from colonizing powers. We defined "colonialism" as "an attitude of mind, accepted by both the leaders and representatives of the colonizing power, and by those who are being colonized, that what goes on at home should also take

place in the colonies" (p. 72). We noted that although this "acceptance" is sometimes a conscious act, more often it is subconscious – "people behave in a colonialist way simply because that is the way they have learnt to behave" (p. 72).

Aside from a very brief discussion of the new Federal decimal currency, and comparisons of local currencies still used in the former American colonies, Nicolas Pike's (1788) text followed the same sequence of arithmetic topics, and the same rule-example-exercise approach, as had been used in European texts. From the 1820s onwards, following the inspiration of Colburn (1821), numerous mental arithmetic texts (often inspired by Pestalozzian inductive approaches) appeared. But, throughout the nineteenth century, textbooks which were dedicated to *written* arithmetic followed the traditional sequence of topics. Thus, for example, in Robinson's (1877) *Progressive Practical Arithmetic for Common Schools and Academies*, the major sections were: simple numbers, common fractions, decimals, decimal currency, compound numbers, percentage, and ratio and proportion. Within these sections, were all of the traditional topics. For example, within the section "ratio and proportion," subtopics included partnership, alligation medial, and alligation alternate, all topics dealt with by Pike (1788) and, arguably, unsuited to the needs of American school children at the end of the 1870s. In the 1790s, Pike's original text proved to be totally unsuitable for American schools, and his 1793 abridgement, designed for the use of schools, was not well received in schools either.

During the nineteenth century the numerous arithmetic texts written by American authors would, with a few early exceptions, all follow the traditional sequence of topics. Some free-thinking writers did try to change the status quo. For example, Erastus Root (1796) wrote forcefully:

> Several very excellent treatises on arithmetic have lately been published; yet none of them seem to be exactly calculated for common schools. The size and consequent dearness of some, forbids their general use; while the deficiency and unnecessary learning of others, ought to exclude them. Transatlantic authors will no longer do for independent America. We have coins and denominations of money peculiar to ourselves: – In these our youth ought to be instructed and familiarized. The simplicity alone, of this our Federal money, is its sufficient recommendation. Its denominations are the simplest possible – being purely decimal. Almost two centuries have elapsed since the invention of decimal arithmetic; yet never, till lately, has it been applied to the weights, measures, or monies of any nation. But it remained for the United States to make the beginning. (pp. v-vi)

Root's text was never widely adopted in US schools, possibly because the new nation's teachers had been thoroughly enculturated into the use of English texts, like Bonnycastle (1778) and Dilworth (1762). Even those who adopted texts written by US citizens preferred arithmetic with traditional emphases – like, for example, those by Adams (1801) and Daboll (1800).

Chauncey Lee (1797) recommended that a new decimalized system of weights and measures be introduced. He argued that "these absurd, untoward fractional numbers" needed to be "banished from practice and the several denominations in all commercial tables of mixed quantities conformed to our Federal money, and established upon a decimal scale," and pointed out that "to accomplish all this is a talk too great for any individual in a republican government" (p. ix). What was needed, he said, was "the arm of Congress to effect it," and it was "equally to be hoped and expected, that their wisdom and patriotism will not be inattentive to so important an object of legislation" (p. ix). Lee (1797) then put forward his system of units, and pointed out that "an unnecessary multiplication of the tables of compound quantities will not facilitate the study or practice of arithmetic, but have a contrary effect" (p. xxvii). Warming to his theme, he added:

> And, let me ask, what real necessity can there be of having such a diversity of weights? What even imaginary necessity, abstract from the current of arbitrary custom and habit?

> What benefit from it to society in general, or to the tuition of schools in particular? What good purposes are answered by it in the transaction of any kind of business, or in the operation of any arithmetical calculation whatever, which would not be as well, and on the whole much better answered, by reducing them all to practice to a single standard; and ascertaining the gravity of gold, iron, medicines, and all kinds of substances, now classed under three different sorts of weights, by one common table of weight, distinguished and dignified by the name of *American weight*? (p. xxvii)

Lee's text reflected *his* commitment to change. But the new US society was reluctant to move as quickly as Lee wanted, and the most popular arithmetic texts written by American authors were those in which the traditional sequence of arithmetic topics, and even the traditional British units for measurement, were maintained. Cajori (1907) blamed the American people for this. He argued that "so long as this free and independent people chooses to be tied down to such relics of barbarism, the arithmetician cannot do otherwise than supply the means of acquiring the precious knowledge" (p. 218). The fact that, as late as the 1870s, children in the United States of America were still doing business calculations using English Sterling currency (Robinson, 1877) points to the inertia perpetuated by authors and publishers who regularly claimed that their texts were especially suited to the needs of the new nation.

A Contrasting Example: Mathematics Textbooks in Australian Schools

This paper has been mainly concerned with identifying and commenting on the process of decolonization with respect to school mathematics textbooks in the United States of America. The paper was prepared for a group of scholars interested in the history of mathematics education who attended the 2008 twelfth International Congress on Mathematical Education (ICME 11), held in Monterey (Mexico). With respect to school mathematics, many of the nations represented at ICME 12 might be classified as either "colonizers" or "colonized". Have the patterns of colonization and decolonization with respect to school mathematics textbooks been similar to the pattern described for the United States? In the case of the United States, it took a major event in history – the Revolutionary War – to establish a climate which inspired, even empowered, educators to break the colonial fetters.

Over the past decade, we (Ellerton and Clements) have been in the process of establishing a "history of school mathematics" library in Australia. We have set ourselves the goal of acquiring at least one copy of every school mathematics textbook ever used in Australian schools during the 200-years period 1778-1988. We are well on the way to achieving our goal. What stands out to us, is that prior to the era of New Mathematics (in the 1960s), most mathematics textbooks used in the senior classes of Australian secondary schools were imported from the United Kingdom. Interestingly, we have not found one American mathematics textbook commonly used in Australian secondary schools before the New Mathematics period.

By contrast, after the New Mathematics period, most of the mathematics textbooks used by senior classes in Australian secondary schools were written by Australian authors and published in Australia. Some UK texts, especially those associated with Cambridge University Press's School Mathematics Project (SMP) were used, and some US texts (e.g., those written by Dolciani and co-authors) were introduced.

Our experiences in several Southeast Asian nations suggest that similar patterns occurred there, with the introduction of New Mathematics curricula serving as a catalyst for locally produced texts.

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