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A Comparative Study on How Mathematical Culture Is Implemented in the Textbooks.

Abstract

Mathematics is a vital intellectual heritage of human beings, but few are aware of its relationship with culture. Though there is no agreement among scholars regarding the definition of culture, in 1952, the American anthropologists Kroeber and Kluckhohn had critically reviewed concepts and definitions of culture and claimed that culture consists of patterns, explicit and implicit, of and for behaviour acquired and transmitted by symbols, constituting the distinctive achievements of human groups, including their embodiment in artifacts. Based on Kroeber and Kluckhohn’s definition, it is appropriate to say that mathematical culture consists of algebraic/geometrical patterns, explicit and implicit, of and for behaviour acquired and transmitted by mathematical symbols (notations, diagrams, and writings), constituting the distinctive achievements of human groups in general, mathematicians in particular, including their embodiment in artifacts. It is claimed in this study that “mathematics in culture” (MiC, a macro-view of the development of mathematical knowledge) and “culture of mathematics” (CoM, a micro-view of the development of mathematical knowledge) are the two main dimensions of mathematical culture. This study has two purposes. First, I attempted to identify the constituents of mathematical culture in terms of the interrelationship between mathematics and culture, particularly the interaction of mathematics with Eastern and Western culture. Second, I selected three sets of high school mathematics textbooks from Taiwan, China, and the United States respectively to investigate how, if any, mathematical culture is implemented. Table 1 shows the framework for reviewing the content of mathematical culture in these textbooks in which the dimension of “mathematics in culture” consists of historical, societal, and ethnic aspects, and “culture of mathematics” is constituted by inductive, deductive and dialectical aspects. The number shown in the grid represents the frequency of particular content (problems, examples, exercises, etc.) related to the Dynamic and Static indices.

Table 1

Dynamic index / Static index		Induction & Guessing			Deduction & Proof			Community & Dialectic	
		Survey	Pattern	Conjecture	Intuition	Example	Logic	Community	Evolution
History	Concept								
	Method								
	Problem								
	Episode								
Society	Nature								
	Living								
	Economy								
	Politics								

	Arts								
Ethno- math	Context								
	Difference								
	Philosophy								

A quantitative analysis reveals that:

- (1) The U.S. textbook involves more elements of mathematical culture than those in the textbooks of Taiwan and China, and tends to explain mathematical concepts by means of intuitive ways.
- (2) Among the three aspects of MiC, the societal aspect is highly emphasized in the three sets of textbooks.
- (3) Ethno-mathematics and dialectical aspect of mathematical knowledge are nearly absent in the three sets of textbooks.

This study will also report on the results of qualitative analysis showing in what way the mathematical culture is implemented in these textbooks.
