CHAPTER 5

Image-Writing Relations in Arabic Mathematical Textbooks

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1 Introduction

In most countries, the dominant view of mathematics is that it is a difficult subject to learn or to teach. A number of studies provide different reasons for that difficulty (e.g. Carpenter, Fennema, & Franke, 1996; Clements & Battista, 1992). Most of these studies, however, adopt cognitive or psychological interpretations of that difficulty until more recently, when research of mathematics education began to use a social lens. Lerman (2000) discusses this social turn in detail. One approach of such social interpretation is to view mathematics education as communication. Researchers need to understand how this communication works in order to suggest different interpretations for difficulties in learning and teaching mathematics (Pimm, 1987; Sfard, 2008). Mathematics is, among other things, “a social activity, deeply concerned with communication” (Pimm, 1987, p. xvii). Any communication is inevitably multimodal, meaning that different modes, such as language, images and gestures, are used to make meaning (Kress, 2010). In this vein, studies in mathematics education focus on analysing language (e.g. Morgan, 1996; O’Halloran, 2005), diagrams (e.g. Alshwaikh, 2011) or gestures (e.g. Radford, Edwards, & Arzarello, 2009). These studies tend to analyse each mode separately, however, and do not always address the interaction between the various modes of communication.

This chapter describes a project that sought to apply a multimodal analysis, analysing how words and images work together to create mathematical meaning and how such interaction affects teaching and learning. The context for the project was the perceived difficulties with mathematics education—and specifically with mathematics textbooks—in Palestine. Together with Candia Morgan, I undertook a year-long project (2012–3), Analysing the Palestinian

school mathematics textbooks: A multimodal (multisemiotic) perspective\(^1\) (Alshwaikh & Morgan, 2013), that analysed the interplay of images and words in Palestinian mathematics textbooks. This chapter presents the analytic method developed to analyse words and images, its application to Palestinian textbooks and its potential for impacting practice and research in mathematics education.

I begin by presenting an overview of how scholars have viewed the relations between mathematics and language, moving toward the notion of mathematics as discourse. Then an analytical tool is introduced to understand the relation between words and images in mathematics discourse. After introducing the analytical tool, the last section applies this analysis to Palestinian mathematics textbooks, looking at how words and images interact to present a particular view of mathematics activity and a particular role for learners. The chapter concludes by discussing possible consequences of how that view of mathematics and that role defined for students may impact students’ engagement in their learning process.

2 Communication, Language and Mathematics

The dominant view of mathematics among mathematicians used to be, and may be still, that mathematics has its own specialised language: ‘mathematical language,’ which comprises symbols alongside numbers and other specialist mathematical vocabulary and notations (Morgan, 2009). Consistent with this view, mathematicians and mathematics educators considered verbal language as an “imperfect, imprecise and ambiguous version of the symbolic systems of mathematics” (Morgan, Ferrari, Duval, & Høines, 2005, p. 789). Learning mathematics, according to this view, is the ‘acquisition’ of that mathematical language and the ability to read and speak it (Aiken, 1972). Students’ mathematics-learning difficulties were attributed to their lack of understanding of the mathematical terms and vocabulary (Austin & Howson, 1979).

The relationship between natural language and mathematical symbolism and specialist vocabulary was investigated by Halliday (1974), who introduced the notion of a register. Mathematics register refers to the meanings one can make using mathematical vocabularies (Halliday, 1974). One main feature to which Halliday refers is the use of metaphors in mathematics register, speculating that this use of metaphor may be the reason that some find mathematics difficult to learn and to teach. Pimm (1987, p. 8) mentions the response

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