Chapter 26: Language Factors in Mathematics Teaching and Learning

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ABSTRACT

Although language factors have long been recognised as having an important influence on mathematics learning, possible frameworks for researching the nature and extent of that influence have only been developed relatively recently. In this chapter the authors emphasise one of these frameworks, and summarise pertinent research findings which have implications for mathematics teaching and learning.

Possible reasons for the dearth of research in linking language factors with mathematics education during the 1980’s are put forward. The chapter draws attention to a range of factors – including social, cognitive, cultural, linguistic, and affective – which impinge on the development of a wider range of communication patterns in mathematics classrooms. Several areas – including writing in mathematics, bilingualism in mathematics teaching and learning, and language and assessment of mathematics learning – in which there is a danger that potentially false assumptions are likely to influence practice, are identified. Evidence is put forward indicating that carefully designed research studies in these areas are urgently needed.

1. LANGUAGE FACTORS IN MATHEMATICS TEACHING AND LEARNING

1.1 Some Historical Perspectives

Perhaps the first major commentary on the role of language in mathematics education appeared over 40 years ago, in the form of a paper written by Brune (1953). He noted, in particular, that ‘words are links in the chain of communication’ (p.160), that ‘mathematical words often represent mental constructs rather than tangibles’ (p.161), that ‘spoken words are symbols’, and that ‘words represent agreements among people’ (p.161). Brune referred to different meanings associated with the same word in different cultures, to the ways in which context can clarify the meaning of specific words, and to the importance of semantics (which he described as a young discipline). He also discussed the importance of having pupils work on projects which have been specifically designed to emphasise mathematical concepts. Brune maintained
that once students understood concepts through their own experiences, they should have the opportunity of communicating the mathematical principles underlying these concepts to their classmates.

Brune’s (1953) paper effectively foreshadowed most of the elements and themes which are currently being taken into account by those who are concerned to investigate relationships between mathematics, mathematics education, and language. Brune made no attempt, however, to link the various factors he identified as important in his consideration of mathematics and language.

The broad term ‘language factors in mathematics learning’ has been used in recent years to refer to diverse research areas – from psycholinguistics and sociolinguistics to classroom discourse, and to teaching mathematics in bilingual classrooms. A quarter of a century ago, Aiken’s (1972) review focused on the crucial role of classroom discourse, for example. In the 1970’s and 1980’s researchers tended to work in separate camps, largely unaware of what was being studied in closely related fields. At that time, the expression ‘language factors in mathematics learning’ meant different things to different people.

Historical perspective makes it clear that what was needed was some kind of coordinating framework which not only identified the main components of the field, but also began the task of investigating issues and relationships within and between these components. In their review of language and mathematical education, Austin and Howson (1979) presented a ‘framework for discussion’ which, they said, would impinge on a range of disciplines, including sociology, psychology and anthropology. As a starting point, they listed three key issues concerned with teachers and learners — do they share

a) the same language;
b) the same culture; and
c) the same logic and reasoning system?

In the light of the comprehensive early reviews by Brune, Aiken, and Austin and Howson, it is somewhat surprising that comparatively little research in the language and mathematics area was published in the early 1980’s in the United States. One possible reason for this could be the straitjacketing of research by two influential books which set out to define the research agenda for mathematics education – *Critical Variables in Mathematics Education* (Begle, 1979), and an edited collection of articles, *Research in Mathematics Education* (Shumway, 1980).

Begle identified five key issues for mathematics education research:

a) the relationship between teacher knowledge of subject matter and student achievement;
b) drill;
c) expository teaching of mathematical objects;