

Thompson, Ian (Ed.):

## Issues in Teaching Numeracy in Primary Schools

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As the editor indicates in the preface, this book considers research, mainly in England and the Netherlands, which deals with a range of issues relating to the teaching of numeracy in primary schools. The chapters are written by individuals active in various capacities with children's numeracy learning. I am familiar with some of the authors (e.g. Hughes, Merttens, Treffers, Thompson, Sutherland) through my previous readings of their research in the literature; I had the privilege of reading about the work of other authors (e.g. Brown, Reynolds & Muijs, Beishuizen, Straker, Harries, Askew, Higgins, Close, van den Heuvel-Panhuizen, Anghileri and Ruthven) for the first time here.

Although the sixteen chapters are grouped under four sections and cross reference each other where appropriate, each chapter stands alone in its discussion of particular issues raised. For this reason, I will review each chapter separately at first and then close with some general comments and reactions to the book as a whole.

### Section 1: Numeracy: Issues past and present

#### *Chapter 1: Margaret Brown*

In this chapter, Brown recounts for us the "swings of the pendulum" which have occurred over the years leading to the current National Curriculum in England and the National Numeracy Strategy Framework circulated in 1999. In particular, she recaps the cyclical nature of debates around individualised versus whole class instruction in primary schools. She points to the return of an emphasis on mental and paper and pencil mathematics with calculator use moving to the background. As she indicates, that regardless of the swings, a consistent theme over the years has been "poor standards in number skills" (p. 3), in that there has never been a time when those who speak for our nation have been satisfied with the level of numeracy achieved by primary children (p. 4). Most startling about her contributions is the discussion of how teacher/student autonomy is progressively worn away. On one level, this chapter confirms the stereotypical sense I held that Britain's current moves toward the National Curriculum was in many ways a retrogressive step – succumbing to "Back to Basics" pressures represented in media and by popular opinion polls. And yet, she effectively sets the scene for later chapters and discussions which point to the creative and positive ways educators responded in the British context so that numeracy in a broad sense constitutes those "basics".

#### *Chapter 2: David Reynolds and Daniel Muijs*

In this chapter, the authors take for granted that numeracy matters and begin to explore effective teaching methods.

Early in the discussions, whole class interactive teaching is addressed, because of its use in other cultures and countries where TIMSS results were better. At first this seems too simplistic: I felt as if the authors had fallen victim to the "swings" spoken of earlier, where we move from individualistic notions to directed teaching. As I continue to read, these authors delineate more clearly what is envisioned by whole class teaching and explicate the virtues of teacher as class inquirer, where high level questions and whole class participation are pivotal components to good teaching in this format. Next the authors explore cooperative grouping and problem solving, first by pointing to studies of these ways of learning numeracy and then through general discussion of the positive aspects of cooperative problem solving. The lack of references at this point somewhat weakens the stance but none the less, a compelling argument for a mix of whole class teaching and cooperative groups is made, with the Pacific Rim experience cited as a case in point.

#### *Chapter 3: Adrian Treffers and Meindert Beishuizen*

In this chapter, the authors introduce Realistic Mathematics Education (RME) as it was developed with and through Freudenthal and his institute in the Netherlands. Their differentiation between applied problems and real world problems is instructive. Likewise, their discussion of the role of context problems in encouraging mathematizing and its significance in distinguishing real world problems from applications is informative. Children's re-invention of structures is described through division examples and the adjustments made when the role of mental arithmetic enters the picture is also discussed. In addition, the current RME resources used in the Netherlands are illustrated through student examples. The authors' attempts to explain horizontal and vertical mathematization proved insufficient for this novice, but obviously set the scene for me, because when these concepts resurface in a later chapter regarding the use of the Empty Number Line (ENL), these concepts become clearer.

#### *Chapter 4: Anita Straker*

The *National Numeracy Project* (NNP) in Britain is the focus of this chapter. The first definition of numeracy is given and points to "flexibility with number" and "operations on number" as central components. Descriptions of NNP at the school levels and *The Framework for Teaching Mathematics* are shared. A sample lesson is used to illustrate key points further. Straker's focus on "distinguishing characteristics of the project" such as "interactive whole class teaching and the emphasis on mental methods" successfully inform the reader of two key features of interest. I am particularly impressed that children's mental computation as examples for discussion in mathematics lessons is strongly supported, and early introduction of standard paper and pencil algorithms is questioned, as it seems to dismantle the stereotype of "basics" as "recall of facts".

### Section 2: Curriculum and research project issues

#### *Chapter 5: Tony Harries and Rosamund Sutherland*

The focus of this chapter was on textbooks at primary levels and various issues concerning "textbooks as old fash-

ioned” to the notion that “textbooks provide a window into education beliefs” are raised and discussed briefly. The authors then delineate their criteria for analysis and examine various text series available in different countries, namely England, Singapore, France, Hungary and USA. In particular, they focus on models for multiplication and division in different countries as represented in the different schemes. The authors are to be commended on the detail with which they examine each of the schemes and the comparisons highlight issues involved in debates over concrete/abstract; the role of properties like commutativity; and so on. It is disconcerting that “the English text is poor” seem to be a foregone conclusion. In addition, the illustration used for the French text does not aptly support the claims made.

**Chapter 6: Martin Hughes, Charles Desforges and Christine Mitchell**

Applying mathematics to different contexts is the theme developed in this chapter. The authors establish the importance attributed to “Using and applying mathematical knowledge” over the years and argue that application has little priority within the National Numeracy Strategy (NNS). This point alone was instructive since it seems to contradict the impression and the desire presented in other descriptions of the NNS. These authors then describe a project, funded through the Nuffield Foundation, aimed at developing “new ways of thinking and new teaching approaches to the problem of application in mathematics” (p. 69). Examples from three teachers at Key Stage 1 are provided and although descriptions are brief they prove to be sufficient for this reader. I believe the authors succeed in demonstrating that there are a range of ways in which teachers can help children apply their mathematical knowledge which fulfill *The Framework for Teaching Mathematics*. In addition to the overall message of encouragement and support, these brief descriptions point to constructive and manageable ways we may begin to assist teachers struggling to change their practice. For instance, no specific methods are given to the teachers but rather teachers involved in the project are asked to be thoughtful about “how they might help their pupils apply mathematical knowledge ...” (p. 69).

**Chapter 7: Ruth Merttens**

In this chapter, the author draws upon her experiences with the IMPACT project. What is at the core of Merttens’ discussions however seems to be the distinction between homework and parent involvement in their children’s education. Her presentation of the stances taken by the public on homework and in turn its iconic role is informative. Reference of the role of parents prior to school provides a sound basis for her argument that involving parents is not optional but necessary for success. Although a brief comment in this chapter, it succinctly captures findings from my research with parents and preschool children (Anderson, 1997). In turn, Merttens provides solid evidence that parents can and have been involved in different school/family projects and she offers sound and reliable suggestions for educators to consider.

**Chapter 8: Mike Askew**

This author opens his chapter with a poignant example of a child, John, who uses tallies and counting to solve  $278 + ? = 500$  and eloquently makes the argument that this is not sufficient, thus leading us toward his study of effective teaching. In the *Effective Teachers of Numeracy Project*, the effectiveness of a teacher is connected to his/her children’s numeracy achievement and this stance is adequately discussed and described. In turn, the author points to orientations of teachers as important considerations for effectiveness. The claim that “connectionist” teachers are effective and how connectionist teaching differs from “transmissive” and “discovery” orientations raises interesting points for consideration.

**Chapter 9: Steven Higgins and Daniel Muijs**

In this chapter on *Information and Communications Technology* (ICT), the authors share a poor prognosis for computers to be able to provide numeracy related programs. The authors are skeptical that we will move much beyond the skills and practice type of number related software. Constructivist based software and behaviorist based software are discussed. The authors also explore teacher roles but again seem skeptical that success will be met. Ideas to consider are provided and the general ideas seem to contradict the pessimistic predictions of earlier paragraphs. In discussing implications for teaching then, the authors alert teachers to the need to compensate for shortcomings of the computer materials and suggest effective use of ICT for numeracy lessons.

**Section 3: Assessment issues**

**Chapter 10: Gill Close**

A discussion of aims of assessment is followed by two illustrative examples in the style of posing a misconception with which children grapple. However, the link between the specific questions and the aims is weakened when the discussion around the questions focuses on the possible responses they may elicit. That said, the author does succeed in leaving the reader with a general idea of how these represent some of the aims established and in addition provides some insight into children’s responses to such questions. The discussion of shortcomings in test questions such as potential wording and marking schemes brings to light other important issues. Overall the author points to ways we might examine assessment items as well as ways to make written assessment more accountable.

**Chapter 11: Marja van den Heuvel-Panhuizen**

This author offers the practice of context problems used in RME in the Netherlands as exemplars for alternatives within a range of class administered written tests. The Dutch system (RME) is described and it is indicated that 3/4 of the text series available are inspired by different degrees by RME. She speaks of problems suitable for mathematization and points out characteristics like minimal text, and pictures that are self explanatory as strengths for supporting the “child’s” learning. This is a cogent point of importance for all children. For those of us working with large immigrant populations and English as Second language (ESL) learners, these examples provide strong

alternatives to the more text laden ones. The examples are well explained and demonstrate the strengths they offer for written tests environments. Discussion of accessibility, elasticity and transparency as means by which context problems can enrich assessment is informative. An expression of significance for me was “locating a foothold for instruction” where this author speaks of test items not checking for prerequisite skills but rather seeking what a child can do even prior to instruction. A balanced view is provided and children’s work is included. The notion of a “safety net question” (i.e. having a second question which probes on the significant mathematics of an initial question) providing an “interview flavor” to written test items is insightful, also.

#### Section 4: Pedagogical issues

##### *Chapter 12: Ian Thompson*

Here we are asked to consider what is meant by mental arithmetic and moved to consider an image incorporating “recall of facts and figuring”. He accurately recounts research findings for adding and subtracting numbers to 100 and offers an “extended model of mental calculation” (p. 152). His brief discussion of quick calculation versus known fact successfully jolted me out of my complacency of what recall may entail. His statement that children make fewer errors when they use their own methods provoked me to ask – are children ever confused by their own sense making and where it is going? He ends with a note from the past where as early as 1856 mental arithmetic was recognised as a worthier pursuit of instruction than “teaching by rule” (p. 155). Overall then much “food for thought” is shared.

##### *Chapter 13: Meindert Beishuizen*

Here we are given a detailed description of the *Empty Number Line* (ENL) model for basic computation which is considered an alternative to number base blocks often used in North America or the filled number line. The background discussion is informative and helps the reader understand why such a model as the ENL might be created and implemented. Illustrative examples from children’s work are included throughout. The author speaks of diagnostic feedback and the sequential (versus base ten) way of linking with the standard algorithm as strengths embedded in the nature of the ENL and its use in classrooms. However, since most of the examples seem to be of children at a later stage of use (i.e. using shortcut strategies), I was puzzled as to why and how such a seemingly abstract organiser (an empty number line) supports learning. At this stage, it seems more like a recording device (a way to write your “figuring” down) rather than an object of query and investigation (which it probably is in earlier stages).

##### *Chapter 14: Ian Thompson*

In this chapter, Thompson refers to “errors” as child methods. Here, he argues that children’s mental methods operate differently than standard paper algorithms and therefore, they do not lead into one another as one might like to hope. Examples of children’s informal non-standard algorithms are well presented and discussed, and point to how these written methods model children’s mental methods.

The discussion of formal standard algorithms is succinct and summarises well the difficulties they present. The section on formal non-standard algorithms offers a wide range of possibilities for each of the four operations and provides rich alternatives for teachers to use in the classroom if they feel they must move beyond children’s methods. Much of what Thompson presents here resonates well with Kamii’s (1998) research.

##### *Chapter 15: Julia Anghileri*

This chapter raises and discusses the issues of paper and pencil algorithms for multiplication and division. Why multiply or divide, and the role of long multiplication and long division in today’s curricula is at the core of the chapter. This author talks of early chants with skip counting as being foundational to multiplicative and partitive language. She speaks of the role of appropriate interpretation of symbols and how one interprets remainders and representations such as decimals. Children’s errors are discussed in light of developments which emphasize “chunking” and number sense. Kelleher (1996) also points to the important role of “chunking” in early number sense. Consistently, the role of understanding and the need to connect written and mental procedures are woven throughout the chapter.

##### *Chapter 16 : Kenneth Ruthven*

Here the author focuses on the *Calculator Aware Number Project* (CAN) in particular and it’s influence on the National Curriculum in England. Limited impact in classroom practice is discussed and then followed by the debates of “calculator beware” versus “calculator aware”. Research regarding calculator use is provided but overall, the studies seem inconclusive due to design concerns. A task based interview with a child serves to background what a teacher should or should not do in certain circumstances. In this way, issues regarding teacher intervention, the role of decimals, the notion of constant keys and repetitive calculations are discussed. The chapter ends with a calculator game which encourages children to explore numbers. Overall, some good ideas for classroom use of calculators are provided.

#### Reviewer’s general comments

A strength of this book is the multi-layered readings it provides. The authors write about many significant issues in primary education and through their discussions offer the readers both information and insight. On one level, we gain knowledge of and insight into the two countries’ movements and debates; in particular the National Curriculum and the National Numeracy Project in England and the Realistic Mathematics Education in the Netherlands. In addition, we are offered opportunities to share in and investigate children’s methods and reasoning through the numerous rich examples of children’s work woven throughout. On another level, we are informed of particular projects such as RME, ENL, CAN, NNS, and so on as well as the knowledge gained from them and the issues raised. We are engaged, through reading, in the discussions of numerous issues such as mental computation and child methods, the idea of chunking, the notions of writ-

ten test alternatives, the place of standard algorithms in primary classrooms and so on.

Although imparting trends and issues in England and the Netherlands, a reader from outside those countries, such as I, is drawn to similarities and differences with more local contexts. For example, the numeracy definition (BCAMT, 1997) currently adopted by the British Columbia (Canada) Association of Mathematics Teachers and the Ministry of Education is similar to that quoted by Straker, p. 41, but also includes spatial reasoning as a component. In offering such broad definitions for numeracy we begin to blur distinctions between “numeracy” and “mathematical literacy” and although this is not commented on here, is it our intent to do so? In addition, many educators and teachers in British Columbia (Canada), promote the use of base ten blocks as “the” way to understanding number operations; yet, the ENL and the discussions of child methods (mental computation) presented here offer alternatives worth exploring in the local context. The calculator debates and the role of computers parallel many of the discussions within this province as well. The late introduction of algorithms has yet to become a topic of discussion in our Ministry of Education, although in recent curricula changes numeracy is receiving a higher profile.

Another strength of this book lies in the varied sources used to support arguments, which include research as well as field experiences. A balanced approach of support for and critique of issues is achieved. Broad coverage of issues with respect to curriculum for all 4 operations with whole numbers, pedagogy, assessment and technology proves a rich combination. However, with little attention given to fractions and decimals, readers may conclude that mental calculation, flexibility with number, and in turn, numeracy, is restricted to whole numbers. On the other hand, it may provoke the reader to question, as I did, the significance it may have for our constructions of “numeracy” and what it means. How do children work mentally to solve fraction and decimal problems? What special considerations does operating with decimals and fractions (and negative numbers, etc.) raise for numeracy development?

In addition, the authors speak to a broad audience. I want to share chapters with my graduate students because of the issues raised, the research insights provided and the ideas for further research lying within. I want to share it with preservice and practicing teachers since the classroom ideas presented are worth exploring in our contexts; and the children’s work provided would readily serve as springboards for rich conversations about children’s reasoning and thinking. In addition, many of the children’s examples would serve as catalysts for conversations with parents. Curriculum developers and textbook publishers would benefit from becoming aware of the text series in other countries. Thus, *Issues in teaching and learning numeracy in primary schools* offers valuable insight and guidance to all of us involved with children’s mathematical learning.

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