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Critical analysis of science textbooks: evaluating instructional effectiveness

Review of

Myint Swe Khine, *Critical Analysis of Science Textbooks: Evaluating instructional effectiveness*. Dordrecht: Springer. 2003. ISBN: 978-94-007-4168-3. £90.00

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This edited book brings together a diverse collection of chapters each concerned in some sense with analysing science text books. The studies draw upon a range of theoretical frameworks and methodological approaches, and discuss books from different national contexts and aimed at different age ranges of student. The book's main heading is accurate enough as all contributions are either centrally or at least largely related to science texts, and all the chapters are concerned will analysing some aspect or other of such texts. The subtitle is perhaps less directly accurate: in most cases the link with instructional effectiveness is not demonstrated but inferred from theoretical considerations.

Contributors to this volume suggest that textbooks remain an important part of instruction and academic learning. Indeed, the editor suggests that "science educators unanimously agree that textbooks play an important role in teaching and learning process [sic]" (p.303). In his contribution, Binns argued that "in the large majority of science classrooms, textbooks become the curriculum and determine what is taught and learnt about science" (p.239). This seems an extreme overstatement, but the importance given to textbooks in many education contexts cannot be denied.

This book has some quirks (referred to below) as well as strengths, but will certainly be of interest to a those working in science education as an academic field, and to science teachers at various levels. Parts of the book are potentially of interest beyond those working in science education, as the chapters vary in the extent to which they are ground in the specifics of science teaching and learning.

It has been suggested that when research is presented as being located in a specialised subfield of education it can be considered at three levels (Taber 2013). Some research explores issues that are inherent to the specific subfield, and particular to it. In the present volume this might apply to some of the chapters considering how textbooks reflect and present the nature of science and its methodologies and epistemology. These chapters concern rather specific analyses which might be considered inherently science education research, and likely to be of limited interest to the reader working in other educational fields.

A second level of study concerns an issue of wide concern, but conceptualised especially in the context of teaching and learning of a particular subject (such as, in this case, science). There are a number of studies of this kind ('embedded' science education research) represented in Khine's book: where the general issues raised and the types of analysis carried out are likely to be of indirect interest to those working in teaching subjects beyond science, because very similar analyses could readily be undertaken in - say - history teaching or mathematics teaching. That is, the perspectives and methodologies transfer, even if the specific findings are of more narrow interest. The opening chapter by Devetak and Vogrinc could be considered of this nature: most of the criteria these authors suggest for evaluating the quality of a textbook could be useful well beyond science.

A third 'level' of study within a field would be study that was substantially about broad issues, and which seemed to be located in a specific context for reasons external to the research focus itself (e.g. such as when a study is set in a biology classroom simply because a biology teacher offered access, even though the same study might just as well have been carried out in a social science or music class). A chapter in this collection by Bryce concerned with texts for primary learners might be considered this kind of 'collateral' science education research, as it appears to offer a largely general review - drawing on findings from analysis of textbooks in different subject areas - with the science specific material almost grafted on. All in all, then, this book is likely to be of interest to those concerned with analysing academic textbooks across a range of fields - as long as that reader is selective in the chapters or parts of chapters referred to.

Within the different chapters a diverse range of foci are considered. One chapter looks in particular at the use of analogy in texts. One contribution offers a general approach to considering the role of 'graphical' features - another looks more particularly at categorizing the profile of different kinds of diagrams used in science texts. One chapter looks at whether textbooks fit official guidance on teaching science from an inquiry-based perspective; one chapter examines the earth science specific content of general secondary science texts in terms of requirements of a national curriculum; one contribution concerns the language demands made on readers; one chapter explores historical school texts; another considers the way the historical development of science concepts is treated in texts; one study compares books from two rather different educational contexts; one study compares physics and biology texts; one book considers how complexity is addressed in life science texts; and so on.

Generally these varied themes complement each other well, although there is little sense of the authors contributing to a joint project. One chapter cites published papers about work reported in another chapter in the volume, without this being acknowledged. The chapter by Valanides and colleagues suggests that "in the center of any scientific investigation is of course [sic] the ability to design fair and informative experiments by applying the control-of-variables strategy" (p.260). This directly follows a chapter where a key focus had been analysing science texts to see whether they offered a distorted view of scientific investigation as being exclusively in terms of experimental work. A good many scientific investigations, indeed most in some scientific fields (e.g. astronomy), are not experimental in nature as investigators have no control over variables of interest.

Most of the chapters are written appropriately for an international audience, although understandably some describe studies deriving from particular educational contexts, or in a few cases drawing comparisons across particular contexts. One chapter however did seem to be written as though the context it drew upon (the United States) could be assumed to be either of universal interest or to represent a universal state of affairs.

There are some aspects of the volume which are potentially irritating to a reader. For one thing, there are a number of places where text seems clumsy or even nonsensical. As early as the third

sentence of the first chapter the reader is told that “textbooks should be a part of the students’ individual activities, and the teacher can implement it in all stages of the learning process and to those learning methods, which entail working with text” (p.3). Presumably this made perfect sense to the authors and editor - but there was a time when publishers employed proof readers to point out such inadequacies in the text and recommend improvements. Such obscure writing, appearing so early in the book, does little to encourage the reader. This is not an isolated example as other errors can be readily spotted (a subheading in one chapter, ‘Acids and Alkalines’ should presumably be ‘Acids and Alkalis’), but such blips are sparse enough not to make any of the chapters incomprehensible overall. A second minor gripe concerns the list of authors. Usually in edited academic books of this kind the reader is provided with a brief biographical note setting out something of the different authors’ backgrounds and main research interests. Here we have to settle for names and institutional affiliations.

It is also usual for a book of this kind to have some kind of general introduction, although perhaps here the editor felt the chapter selected to start the book did a sufficient job in this regard. The editor did contribute a concluding chapter, although much of this was taken up with an explanation of the structure of the book, and an overview of what the different contributing chapters are about. This would have been much more useful for the reader as an opening to the book (as it was largely redundant by the time the other chapters had been read), which would have left space in the final chapter for Khine to have drawn together themes from the diverse material in the book, and perhaps set out an agenda for taking this area of work forward. Without this, there was little sense of this being a coherent volume, despite it working well as a collection of papers on a common theme.

Of course any collection like this will inevitably be limited in some respects. Few of the contributions are able to actually show what target learners actually made of, or learned from, the text books analysed. There are some obvious gaps - for example, is no one analysing text books with a view to their inclusivity from a cultural perspective (e.g. representing scientists of different gender and ethnicity; or in terms of examples and applications linking to traditional ecological knowledge of indigenous science learners)? There seems to be surprisingly limited linkage between most of these studies and classic work on the role of language in science learning (Lemke 1990; Ogborn et al. 1996; Sutton 1992) or the role of rhetoric in science writing (Halliday and Martin 1993; Gross 1996). Overall, though, there is much here for anyone interested in approaches to analysing textbooks, whether in science or beyond. For authors, publishers and adopters of science textbooks this could be an important collection of papers. The contributions here offer many useful insights for those selecting a textbook for student use, and should be required reading for all science textbook authors.

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