Textbook Dilemmas

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This paper originates from a qualitative self-study into the lived experiences of the author, as a beginning teacher of primary school mathematics. The focus of the study was to identify the influences, issues and challenges of a beginning teacher trying to implement reform-oriented teaching practices. One of the important issues to emerge from data collected in both years of the study was the use of a compulsory textbook and the author's changing perceptions (as teacher and researcher) of its role and value as a teaching and learning tool.

In seeking to explore the influences, issues and challenges a beginning teacher experiences in trying to teach reform-oriented mathematics a phenomenological study incorporating first-person inquiry methods was designed. While this type of research had previously been utilised to examine the experiences of practised teachers in their efforts to implement reformed mathematics teaching (Ball, 2000), the experiences of beginning teachers had not been investigated from this perspective.

In this type of study the phenomenon studied is experienced "from the inside" (Ball, 2000, p. 388) where the researcher/participant is involved in constructing the phenomenon to be studied, offering the opportunity to study what it takes "to enact a certain kind of teaching, classroom, or curriculum" (Ball, 2000, p. 388). This type of study provides the opportunity to "access, uncover, and probe elements of the situation or experience invisible to the outsider. What is it like to do this sort of teaching? What tensions arise? What are the feelings entailed? What are the incentives? What is the underlying reasoning?" (Ball, 2000, p. 388).

Background

Reform-Oriented Teaching

In the recent history of mathematics education, as in all areas of education, the emergence of the constructivist epistemology, as the dominant philosophy, has influenced moves for change (Matthews, 2000). This influence is evident in the previous and current NSW syllabus documents (Board of Studies NSW, 2002; NSW Department of School Education, 1989), as well as the standards document published by the Australian Association for Mathematics Teachers (AAMT, 2002). It also underpins the research literature used to inform the quality teaching model introduced into NSW schools in 2003 (NSW Department of Education and Training, 2003).

A review of the literature indicates that effective mathematics pedagogy can include teaching informed by a range of philosophical perspectives (Forrester, 2007), however, it will be consistent with constructivism in the premise that students are active agents in the acquisition of knowledge, and that effective teaching practice is based on informed and reflective teacher decisions (Koehler & Grouws, 1992). Being informed by current research into mathematics education and quality teaching, effective mathematics pedagogy will be reform-oriented, seeking to develop students' conceptual understanding of mathematics, while improving their attitudes to mathematics and confidence in themselves as learners of mathematics.

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Textbooks and Pedagogy

The value of textbooks in primary school mathematics education is hotly debated (Zevenbergen, Dole, & Wright, 2004), yet more than any other subject area, mathematics relies heavily on their use (Johansson cited in Jamieson-Proctor & Byrne, 2008). The mandated use of a set textbook series across a school is not uncommon in Australia, with some schools employing them as pseudo curricula (McNaught, 2005). While quality textbooks are usually published with teacher-manuals, which provide a range of teaching activities that include the textbook as a resource, it is not unusual for these manuals to be unavailable for teachers and for the textbook to form the basis for mathematics lessons (McNaught, 2005).

Textbooks are traditionally connected with a transmission model of teaching (Alsup, 2003; Boaler, 1998). This model focuses on a procedural approach to the teaching of mathematics and subsequently promotes a procedural rather than a conceptual understanding of mathematics, which has limited value when students are placed in unfamiliar situations (Boaler, 1998). This approach also focuses on the production of correct solutions rather than the thinking processes involved in coming to a solution (Wood, Williams, & McNeal, 2006) and often sees the culture of the mathematics classroom embodied in correctness, precision, prompt recall and speedy task completion (Bauersfeld, 1992).

A good mathematics curriculum is based on rich mathematical tasks (Williams cited in Skoss, 2005); tasks that are "authentic", have a variety of solution paths and require thinking and understanding rather than the memorising of facts, procedures and techniques (Booker, 1999, p. 2). Investigative and open-ended in nature, they encourage students to work mathematically and develop mathematical understanding (Catholic Education South Australia, 2004). In reform-oriented classrooms written work is designed to help students develop a deep understanding of the mathematics, enabling them to clarify their thinking, make connections and understand new concepts (Waters & Montgomery, 1993). In this context writing is used to support explorations and investigations by recording and/or explaining procedures, student thinking and solution attempts (Waters & Montgomery, 1993), enabling teachers to gain insights into students' thinking (Booker, 1999; Waters & Montgomery, 1993). This type of written work is consistent with the 'substantive communication' element of the NSW model of pedagogy where students are regularly engaged in "sustained [oral, written or artistic] conversations about the concepts and ideas they are encountering" (NSW Department of Education and Training, 2003, p. 11).

The Mandated Textbook

The textbooks used in both years of this study were aligned with the NSW K-6 syllabus (NSW Department of School Education, 1989) and part of the same series mandated across K-6 by the school. This series is one of several used commonly in NSW schools. The parents purchased two books, one used in mathematics lessons and the other, a mathematics mentals book, for homework. The series included teacher-resource books but they were not provided to teachers in either year of the study, although a copy was requested in Term 1 of the second year of the study and received in Term 3. Being purchased by parents and mandated across all grades it was an expectation at the school that textbooks would be completed. This was highlighted in the first year of the study when another Year 2 teacher commented: 'I'm going to have to leave out page …, the children just won't be able to do it this year'.

The format of the textbooks restricted the recording of solution attempts and student thinking, as no space was provided for anything other than an answer. Most of the mathematical tasks in both grade textbooks were routine in nature, regularly following a demonstration/explanation and practice format. They frequently provided too many practice activities and specified equipment that was not readily available. The Year 2 book was often daunting for struggling students, especially on addition and subtraction pages, where multiple questions were presented in the form of webs and grids. Some activities required a level of accuracy and precision that did not adequately accommodate the fine motor skills of most children in this age group (Kostelnik, Soderman, & Whiren, 2007). While the Year 2 textbook required reading skills that many students in the class did not possess, the Year 4 text provided no reading challenges for my top ability mathematics class.

In commencing to teach primary school mathematics I had a very clear and well-informed vision of reform oriented pedagogy, acquired through my undergraduate teacher preparation course and honours thesis research. This vision was at odds with the transmission model of teaching, with which I was familiar as a student, and did not include the use of a textbook. The challenge going into this study was to bring this vision to life, while satisfying syllabus and school requirements and dealing with my natural inclination to imitate a transmission model of teaching.

Methodology

A Change That Proved Pivotal

When this study commenced it was envisaged that data would be collected from my experiences in teaching mathematics as a part-time teacher. In this role I would have the complete responsibility for programming, teaching, assessing and reporting the mathematics Key Learning Area (KLA). An action research approach, similar to that introduced into schools in the United States by Corey in the 1950s (Zeichner & Noffke, 2001), would be utilised throughout the study. This would be a reflective process and involve: identifying problems, issues or constraints arising in the planning and implementation of the mathematics program; investigating possible solutions; and determining and implementing plans of "strategic action" designed to bring about positive changes in my teaching (Grundy, 1982, p. 353). Data would be collected through a reflective diary, the teaching program, programming and planning notes and video-taped lessons.

In the first year of the study the Year 2 cohort was divided into three mathematics groups. I taught the middle ability group for one hour, four days per week. In the course of the year the size of the class fluctuated, due to student movements in and out of the school, being twenty-two or twenty-three students at any time. By Term 3 it became obvious that my own experiences of teaching mathematics were not in keeping with the experiences of other novice teachers with whom I was in contact. These novice teachers were teaching across all KLAs, usually on a full-time basis, which added complexities to their experiences that I was not experiencing in teaching only mathematics on a part-time basis. A full-time classroom teaching position was sought and secured; the final weeks of the first year of the study were undertaken as a full-time teacher of a Year 2 class.

In the second year of the study I was the full-time classroom teacher for a Year 4 class. The school policy was to divide the primary cohorts into ability levels for Mathematics and English and accelerate students, where necessary, to higher grades. I taught the top ability

group for Mathematics which consisted of 32 students (29 Year 4 students and three Year 3 students). The Year 4 students were drawn from both Year 4 classes.

While it was never the intention of this research to set up disparate contexts for teaching, in terms of a part-time and full-time workload, the contrast between the experiences of each year was striking. The change provided an unexpected opportunity to differentiate, to some extent, between those issues and challenges that arose from the unfamiliar nature of reform-oriented teaching and those that resulted from the unfamiliar nature of beginning to teach.

In moving to a full-time classroom position it became clear very quickly that the responsibilities of a classroom teacher would, by necessity, impact the research in terms of data collection and focus. My reflections now included the impact of my workload across all KLAs and the complexities of the relationships in the classroom and wider school community. What began as deliberate, considered action undertaken to bring about change became ad hoc, survival strategies to implement the curriculum without succumbing to burn-out.

Results

The Role of the Textbook in my Teaching

The mandated use of the textbook emerged as an issue of some importance in both years of this study. The factors surrounding its use were complex and interrelated, arising from the nature of the textbook itself, the impact of the full-time workload on me and my teaching, and my inexperience as both a beginning teacher and as a teacher beginning to teach mathematics in ways quite foreign to all previous experiences of mathematics teaching. As a result the textbook was perceived differently throughout the period of the study.

An obstacle. In Term 1 of the first year teaching Year 2 the textbook was perceived as an obstacle blocking my efforts to utilise reform-oriented pedagogy. In commencing at the school I had been given a previous year's program and informed that the textbook was compulsory in mathematics. While the provision of the program was welcome, the mandated textbook was disappointing, as it did not fit with the vision of reform-oriented practice I had developed in my university courses. However, it was an external constraint quite common to teaching (McNaught, 2005) and as such not out of keeping with the experiences of other beginning teachers.

Having never previously witnessed teaching consistent with my vision of reform-oriented pedagogy, knowing where to start was difficult. The vision I had developed was complex and the prospect of implementing the vision was daunting. The textbook and related speed test booklet could take up to 45 minutes of the hour-long lesson, taking time away from activities I saw as more worthwhile such as investigations and problem solving. Its format limited students' solution attempts and provided procedural approaches to understanding, at the expense of conceptual development. Some children had difficulty reading it and reading aloud each page to make sure all students understood it was often a tedious process. I was unhappy with the constraints it imposed on my teaching, making it very difficult to establish anything other than a traditional mathematics classroom. Having never seen an alternate approach to teaching mathematics I floundered in knowing what to do to change the textbook focus of my lessons and reflected: "I feel textbook driven and I don't know how to deal with this. The textbook is imposed by the school and nearly every day a page is assigned. Some weeks there were five [pages] assigned for four days".

Over the school break I shared my difficulties with a well-known mathematics education academic visiting the university. She advised me to focus on introducing non-routine problems as a basis for my lessons, whilst maintaining the compulsory textbook work. This then became the focus of the first cycle of action research to be undertaken in Term 2.

An irritant. Continuing to use the previous year's program and the allotted textbook pages as a basis for my lessons, resources were purchased to assist me in planning activities based in non-routine problems that covered the appropriate mathematical concepts. At the same time I focused on improving students' understanding of the basic addition and subtraction facts by introducing investigations and discussions of patterns and strategies.

The changes saw immediate improvements in students' computational skills and the beginnings of an evolving classroom culture where students regularly found and demonstrated patterns, identified and verbalised their mental computational strategies and analysed why some facts were easier to work out than others. From initially being wary with unfamiliar non-routine problems, students developed an expectation that they would be able to work out a solution, often finding several solutions and as a class finding all possible solutions. For part of each lesson students were encouraged to view mathematics learning as being concerned with the process of getting an answer, rather than just the 'right' answer, and where they were expected to justify and share their solutions and strategies.

As this culture developed the textbook became an irritant, getting in the way of some worthwhile learning opportunities and still driving the mathematics program. I wrote: "I have had some frustrating lessons where problem solving activities have been going well and productively but I have had to bring them to a close to 'do the page' because there is no other time to catch up" and I reflected: "I hate using the textbook…I am thoroughly frustrated by feeling 'driven' by [it]".

For students, an independent use of the textbook required quite advanced reading skills and the format, as well as the number of questions on some pages, was off-putting to a large number of students in the class. I reflected: "Children lose interest and get distracted by friends, some just daydream. Some find the amount of work on the page daunting and give up. A lot just have trouble understanding what to do - some of the problem is 'mathematics' related - a lot is 'reading' related and some is just maturity in understanding directions and being able to follow them…Some of the number pages in the textbook are very tedious, overwhelming in fact for some children. Only those who are very competent at adding (or subtracting) and work persistently, cope well. For a large part of the class they are daunting. I feel open-ended questions would get them doing the operation without the tedium, and the tedium of marking them".

A convenience. In moving to full-time work in Week 6 of Term 4, the mathematics groups that had been operating all year ceased and I became the classroom teacher for one of the Year 2 classes. Commencing with a largely unknown group of children, several of whom presented with quite challenging behavioural difficulties, brought an end to the previously established routines and culture of mathematics lessons. Several issues, including the full-time workload, behaviour management and the need to establish classroom expectations, saw a shift to textbook focused lessons supplemented by the use of manipulative materials. Non-routine problems were outside the experience of most of the children and with only a few weeks of the year left there was no long-term prospect of re-establishing the routines and culture of the previous group. All of the children were

familiar with the textbook and it provided a convenient basis for lessons, supplemented by the use of manipulative materials.

A crutch. In the second year of the study the full-time workload had an immediate and striking impact on all areas of my teaching. The pace and pressure of teaching full-time were relentless and I became increasingly tired and overwhelmed by the demands of the job. The following diary entry, made towards the end of Term 1, is one of many referring to the impact of the workload and gives an insight into the lived experience: "I am…finding it hard to cope…I am so tired that I don't know how to do it. I'm more than tired, I am sick of doing this all the time, I feel like I have no life. When I'm not doing school work I'm feeling guilty. There is so much to do. I don't feel that I'm teaching well, just basically, no time for thorough planning and preparation".

By Term 3 I felt demoralised and lacked motivation. I wrote: "I have found it too hard to incorporate open-ended questions and problem solving approaches with the [school] emphasis on textbook coverage. I feel overwhelmed by the amount of work required, not only in programming, so the text[book] is a life saver. I feel I am coming to terms with the content of the Year 4 mathematics course (this is true of all subjects …) grammar too!".

In this context the textbook became a crutch when no other support was available. It provided content appropriate written work that was linked to the Syllabus (NSW Department of School Education, 1989), it could be supplemented by other activities (many of which were outlined in the previous year's program) and/or by the provision of manipulative materials, with little added preparation. The textbook provided lessons that were on par with those being taught in the classes around me and while not ideal, they seemed the best I could do in the circumstances.

There is no doubt that in this second year of the study my teaching reflected the findings of research which links the use of textbooks to a traditional transmission model of mathematics teaching (Alsup, 2003; Boaler, 1998). While I endeavoured to focus our lessons on the thinking processes involved in coming to a solution, the textbook undermined these efforts by: only providing routine problems; demonstrating procedures to follow in order to solve these problems; providing repeated examples to practise these procedures; and only providing space for answers, making no provision to record student thinking. While a workbook was sometimes used to supplement the textbook, giving students opportunities to record their thinking, the nature of the textbook and its use gave clear messages that mathematics is about the production of correct solutions, rather than the thinking involved in coming to a solution (Wood et al., 2006).

In reflecting on my efforts in that year, I surmise that, while my mathematics teaching fell short of my own standards, let alone those advocated by the NSW model of pedagogy (NSW Department of Education and Training, 2003) or the mathematics education literature, without the textbook the quality of my mathematics teaching would have been considerably poorer.

A support. In reflecting on the role of the textbook in those two years of teaching, it provided a degree of support that was unavailable elsewhere. At the time it was viewed as an obstruction to my efforts to improve my teaching in line with best practice. However, even in the first year of teaching, it provided a basis for my lessons when I did not know where to start in my efforts to make changes in my teaching in line with reform recommendations. In the second year of the study, despite its faults, the textbook provided support in helping me cope with the crushing workload.

Discussion

As a beginning teacher of primary school mathematics I needed assistance and support in providing high quality teaching and learning programs to develop my students' conceptual understanding of mathematics. In positive terms the textbook provided support throughout the two years of the study, offering reassurance that the content of my mathematics lessons satisfied syllabus requirements and met school norms and expectations. The textbook gave clear structure to my program, simplifying programming and daily planning. This became especially important in the second year of the study when the workload became intense and relentless and when my resilience and ability to cope diminished.

In negative terms, its inherent features and mandated use made the textbook inadequate in providing the written component of mathematics lessons and problematic when trying to implement reform oriented teaching practices. The textbook:

- only offered routine problems that were introduced by demonstrated procedures and facts, constraining my efforts to teach mathematics for conceptual understanding. This encouraged students to see mathematics as facts, skills and procedures.
- provided no space for recording anything other than answers, restricting efforts to build a classroom culture that valued thinking over right answers. This meant that no insights were available into student thinking, other than those deduced from common student errors.
- made it difficult to repress my natural inclinations to utilise a transmission model of teaching and to encourage students to actively engage with the mathematics.

Berliner (1988) argued that beginning teachers should not be expected to be creative lesson planners at the most vulnerable time of their careers, suggesting that they be supported by the use of manuals, lesson scripts and prototypes, regardless of the deficiencies of these resources. My experiences as a novice teacher have led me to the same conclusion. The challenge is to ensure that current textbooks, associated teacher-manuals and resource books are research based and innovative, incorporating reform oriented teaching and learning practices.

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