



## Incomplete Journeys: Code-switching and Other Language Practices in Mathematics, Science and English Language Classrooms in South Africa

Mamokgethi Setati , Jill Adler , Yvonne Reed & Abdool Bapoo

To cite this article: Mamokgethi Setati , Jill Adler , Yvonne Reed & Abdool Bapoo (2002) Incomplete Journeys: Code-switching and Other Language Practices in Mathematics, Science and English Language Classrooms in South Africa, Language and Education, 16:2, 128-149, DOI: [10.1080/09500780208666824](https://doi.org/10.1080/09500780208666824)

To link to this article: <http://dx.doi.org/10.1080/09500780208666824>



Published online: 29 Mar 2010.



Submit your article to this journal [↗](#)



Article views: 1215



View related articles [↗](#)



Citing articles: 55 View citing articles [↗](#)

# Incomplete Journeys: Code-switching and Other Language Practices in Mathematics, Science and English Language Classrooms in South Africa

*Mamokgethi Setati, Jill Adler, Yvonne Reed and Abdool Bapoo*  
*University of the Witwatersrand, Private Bag 3, P O Wits 2050, South Africa*

In this paper we describe and discuss the language practices of mathematics, science and English language teachers and learners in a sample of urban and rural, primary and secondary schools in South Africa. We focus particularly on the reception and production of language through code-switching, exploratory talk and discourse-specific talk. We situate the article in the policy and practice environment of post-apartheid South African education in which additive bi/multilingualism is officially advocated. We use the metaphor of a journey to describe how teachers and learners move from informal, exploratory talk in learners' main languages to discourse-specific talk and writing in English. A key finding from our study is that few teachers and learners completed this complex journey and that the constraints differed across classroom context, level and subject being taught.

## Introduction

In 1996, the University of the Witwatersrand introduced an in-service teacher development programme: the Further Diploma in Education (FDE) in Mathematics, Science and English Language Teaching. At the same time a research project was launched with the aim of investigating teachers' 'take-up' from this programme. The research team wanted to learn about participating teachers' experiences in order to do the following:

- improve the programme for future teacher participants;
- inform in-service teacher education (INSET) policy and practice in South Africa;
- inform international debates on in-service professional development.

Central to the research project and the substance of this paper is the understanding of a teacher as working with resources (including languages) in context. The data on which the writers draw were collected in ten rural and urban primary (Grades 1–7) and secondary (Grades 8–12)<sup>2</sup> schools in the Northern Province and Gauteng,<sup>3</sup> in which a selection of the 1996 cohort of FDE teachers were working. Each of the teachers in the sample was visited for one week in each of three successive years (25 teachers in 1996, 23 in 1997 and 18 in 1998, with the numbers changing as a few teachers were transferred or dropped out of the programme or were working in contexts where schooling was disrupted). The data include transcribed interviews with each teacher for each of the three years, teacher narratives and responses to questionnaires, observation schedules and notes from the lessons observed, videotapes of some of the lessons, examples of

learners' work. Methodologically, while the research project has 'project evaluation' elements to it, it is more appropriately described as a practice-based (Lampert & Ball, 1998), case study of cases (Bassey, 1999). The FDE is the overall case, with the teachers constituting a collection of particular cases. The research aimed to learn from teachers' classroom practices about their practice. However, the focus was on the relationship between this practice and the practices in the FDE programme (Adler & Reed, 2000; Adler *et al.*, 1997; Adler *et al.*, 1998).

In this paper we describe and discuss what the research team learned about the language practices of teachers and learners in the ten schools. We focus particularly on the reception and production of language through 'code-switching', 'exploratory talk' and 'discourse-specific talk'. We begin with a brief description of the language teaching and learning contexts in South African schools – what we have come to call their *language infrastructure*.

### Language Infrastructure across South African Schools

With the exception of texts used for the teaching of language as subject (e.g. isiZulu, seTswana, French, Portuguese), most teaching and learning materials used in South African schools are printed in either Afrikaans or English. However, Afrikaans and English are the main or primary languages of only a minority of the country's teachers and learners. The majority of South Africa's teachers work in classrooms and schools where English is officially the language of learning, but is not the main language of either the teachers or the learners.

The teachers in the FDE research sample worked in a variety of multilingual or bilingual contexts. In each of these contexts English was not the main language of teachers and learners. English language teachers had the responsibility of teaching English as an additional language. Mathematics and science teachers faced the double challenge of teaching their subject in English while learners were still learning this language.

One of the most significant contextual differences was in what we have termed *the English language infrastructure* of urban and rural schools and communities. We agree with Ringbom (1987) that it is important to consider the contextual differences between 'second' (in South Africa now commonly referred to as 'additional') language acquisition/learning and 'foreign' language learning.

In a second language acquisition context the language is spoken in the immediate environment of the learner, who has good opportunities to use the language for participation in natural communication situations. Second language acquisition may or may not be supplemented by classroom teaching.

In a foreign language learning situation, on the other hand, the language is not spoken in the immediate environment of the learner, although mass media may provide opportunities for practising receptive skills. There is little or no opportunity for the learner to use the language in natural communication situations. (Ringbom, 1987: 27)

In *rural schools*, most teachers and learners in our sample shared the same main language, though there were exceptions to this. Learners in these schools typically only spoke, read or wrote in English in the formal school context. Reading

material (in any language) was limited to textbooks and in some schools learners had few opportunities to use these books, either because one class set had to be shared among several classes or because teachers wished to preserve a scarce resource. In general, together with an impoverished socioeconomic context, the English language infrastructure of these schools was extremely limited. In such schools, though English is the official language of learning and teaching (LOLT) in all but the first three grades, we argue that it is more accurately described as a *foreign language* than as an additional language because exposure to the language is almost entirely limited to the school context. In this article we refer to such a teaching and learning context as a Foreign Language Learning Environment (FLLE).

In *urban schools*, the teachers in our sample worked with learners with a range of main languages. While this multilingual setting complicates teaching practices, the English language infrastructure of urban schools is more supportive of English as LOLT. In urban areas there is far more environmental print (for example, advertising billboards) in English (and in other languages) and teachers and learners have greater access to newspapers, magazines, television and to speakers of English. We argue that in urban contexts it is appropriate to describe English as an *additional language* because of the opportunities that many learners have to acquire the language informally outside the classroom. We use the term Additional Language Learning Environment (ALLE) for schools in urban contexts.

As we will show, these different language infrastructures had an impact on language practices like code-switching – and so too on take-up from the programme.

## Language and Learning as a Focus of Study in the FDE Courses

All of the courses in the Further Diploma in Education programme emphasise the importance of talk as a social thinking tool (Mercer, 1995), and thus for learning: for asking questions, for exploring ideas, for giving opinions, for summarising and reporting findings, etc. Although it is appropriate for much of this learning talk to be in the learners' main language(s), they also need opportunities to speak, read and write in English in the English class. In the mathematics and science classes they need to understand and use formal mathematical and scientific language – usually in English. In other words, teachers need to consider two different dimensions of 'learning talk': (1) the *exploratory talk* which is such a necessary part of talking to learn and which is likely to be most effective in the learners' main language(s) because learners need to feel at ease when they are exploring ideas (Barnes, 1992: 126), and (2) the *discourse-specific talk* which is part of learners' apprenticeship into the discourse genres of subjects in the school curriculum (Wells, 1992: 291). For reasons that will be indicated in the next section of this article, the majority of learners need to develop competence in using English for this discourse-specific talk.

Analysis of the baseline data gathered in 1996 led to a decision, in the next two years of the study, to focus on two key language practices: *learning talk* in all three subjects and *code-switching* by teachers and learners. As is explained below, the language emphasis across courses, and the key practices identified through and

for the research, intersect in critical ways with language in education policy in South Africa, and the goals of the new national curriculum, popularly referred to as 'Curriculum 2005'.

## **Politics and Practice: Language in Education; Language and Education**

Four areas of politics and practice have informed the language foci in FDE courses, and so too the research foci: language in education policy in South Africa, including LOLT; changing pedagogic practices advocated in the new Curriculum 2005; debates on strategies (such as code-switching) for teaching and learning in multilingual classrooms; and debates on the acquisition of discipline-specific discourse (for example, 'the language' of mathematics).

### **Language in education policy and LOLT**

The South African nation is multilingual. The constitution adopted for post-apartheid South Africa in 1996 provides for certain human rights, amongst which are language rights. For the first time nine African languages, Sepedi; Sesotho; Setswana; siSwati; Tshivenda; Xitsonga; isiNdebele; isiXhosa and isiZulu, have been added to English and Afrikaans, the only two languages that enjoyed official status in the apartheid era. Multilingualism is now encouraged through the new constitution, and given educational substance in the South African Schools Act. According to the new language in education policy:

Subject to any law dealing with language-in-education and the constitutional rights of learners, in determining the language policy of the school, the governing body must stipulate how the school will promote multilingualism through using more than one language of learning and teaching, and/or by offering additional languages as fully-fledged subjects, and/or applying special immersion of language maintenance programmes . . . (Department of Education, 1997: 8)

Not only can South African schools and learners now choose their language(s) of learning and teaching, but there is a policy environment supportive of multilingual language practices like code-switching. Learners are to add new language(s) to their repertoires, and not subtract their main language. It can, however, be predicted that most parents and schools will not opt for main language as LOLT, since among speakers of African languages, main language LOLT policy has a bad image. It is associated with inferior education:

Parents' memories of Bantu Education, combined with their perception of English as a gateway to better education, are making the majority of black parents favour English as a [language of learning and teaching] from the beginning of school, even if their children do not know the language before they go to school. (NEPI, 1992: 13)

In fact, English is becoming more and more dominant because the majority of parents want their children to learn in English. This point is forcefully made in

the overall report of the range of classroom-based research projects undertaken across a range of schools during 1998 (Taylor & Vinjevold, 1999).

New language policy in South Africa is intended to address the overvaluing of English and Afrikaans and the undervaluing of African languages. In practice, however, English continues to dominate. Although it is the main language of a minority, English has become both the language of power and the language of educational and socioeconomic advancement, that is, a dominant symbolic resource in the linguistic market (Bourdieu, 1991) in South Africa. The issue of the dominance of English in South Africa is not easy to resolve, and it ramifies in complex ways into classroom practice. In particular, we need to understand that the language practices of mathematics, science and English teachers, and whether and how they embrace talking to learn and code-switching as pedagogic strategies, will not only depend on what policy is stipulated, but also on teachers' skills, their context of practice and what they perceive to be in the interests of their learners. As Baker has argued,

Decisions about how to teach [second language learners] . . . do not just reflect curriculum decisions . . . they are surrounded and underpinned by basic beliefs about . . . [the learners' main languages] and equality of opportunity (Baker, 1993: 247).

The challenges, therefore, for educational practice in South African classrooms are: (1) dealing with the material and political power of English and widespread common-sense beliefs that access to English needs to be enabled as early as possible with no serious regard for main language maintenance; (2) working beyond the stipulated language of learning to include other languages in learning and teaching; and (3) supporting multilingual teaching with appropriate materials and INSET.

In a recently released policy document on implementation of new language in education policy, the beginning of an INSET strategy is articulated:

As the language situation in many SA schools develops away from monolingual teaching, teachers should . . . also be trained to use more than one language of learning and teaching. All teachers teaching in public schools in South Africa are bi- or multi-lingual, but very few of them can teach in more than one language. If the language support for learners is to be provided, teachers will have to be trained to do so. It is furthermore necessary to target all teachers in order to enable them to facilitate language learning in their classrooms – irrespective of the subject or learning programme they teach. (Department of Education, 1999: 17)

There is a clear resonance between language in education policy and implementation strategies that are being developed at a national level in South Africa and the orientation to language and learning both implicit and explicit in the various FDE programme courses.

### **Curriculum 2005 and pedagogical orientations**

In addition to language in education policy, educational transformation in post-apartheid South Africa includes the conceptualisation and development of a new school curriculum. Curriculum 2005 is a slogan system (Apple, 1988) for a

better education for all, one that is driven by principles of success, equity, flexibility and integration. This approach to education is distinct from apartheid education, driven as it was by knowledge fragmentation, racial segregation and inequality. Pedagogical orientations and processes are to promote collaborative and cooperative learning, problem-solving, and meaningful communication between learners and teachers and among learners themselves. All these require learners to interact with both the teacher and other learners.

These interactions are, however, not easy to initiate, sustain and develop in bi-/multilingual classroom settings, be they additional or foreign language learning environments. As discussed earlier, most learners in South Africa are not fluent in English, and this remains the preferred LOLT in many schools. It is indeed ironic that the demand for English as target language has, if anything, increased in the post-apartheid era. With English as target language, and in support of the principles of learning and teaching embedded in the new curriculum, code-switching practices are not only inevitable but necessary in schools where English is being learned at the same time as it is being used as the LOLT. Code-switching is a language practice that could support classroom communication in general and the exploratory talk that is such a necessary part of learning.

### Exploratory talk in the multilingual classroom

Debate on the effects of bi-/multilingualism on the learner goes back decades. We will not rehearse the arguments here as they have been described in detail elsewhere (e.g. Saunders, 1988). Some maintain that bi-/multilingualism has negative effects on language development, educational attainment, cognitive growth and intelligence (Reynold, 1928; Saer, 1963; both in Saunders, 1988). Others argue that under certain conditions bilingual skills can have positive effects on the learning process (Pearl & Lambert, 1962; Ianco-Worrall, 1973; Ben-Zeef, 1977; Doyle, 1978; Bialystok, 1987; all in Saunders, 1988; Auerbach, 1993).

In an article entitled 'The bilingual as a competent but specific speaker-hearer' Grosjean (1985: 471) argues for a bi-/multilingual (or holistic) view of bi-/multilingualism in any consideration of bi-/multilinguals. This is different from the monolingual view, which always compares the linguistic ability of bi-/multilinguals with that of monolinguals of the languages concerned. Bi-/multilinguals have a unique and specific language configuration and therefore they should not be considered as the sum of two or more complete or incomplete monolinguals.

The coexistence and constant interaction of the two languages in the bilingual has produced a different but complete language system. An analogy comes from the domain of athletics. The high hurdler blends two types of competencies: that of high jumping and that of sprinting. When compared individually with the sprinter or the high jumper, the hurdler meets neither level of competence, and yet when taken as a whole, the hurdler is an athlete in his or her own right. No expert in track and field would ever compare a high hurdler to a sprinter or to a high jumper, even though the former blends certain characteristics of the latter two. In many ways the bilingual is like the high hurdler. (Grosjean, 1985: 471)

It can therefore be assumed that language practices in bi-/multilingual classrooms will not necessarily be the same as in any other classroom. In particular, an important aspect of bi-/multilingualism, that which makes the bi-/multilingual person an integrated whole, is code-switching (CS). CS, or switching from one language to another, can therefore be expected to occur in bi-/multilingual classroom communication.

In their study of science classrooms in Swaziland, Rollnick and Rutherford (1996) found the use of learners' main languages to be a powerful means for learners to explore their ideas. They go on to argue that without the use of CS, some students' alternative conceptions would remain unexposed. A key finding was that learners' written work may conceal misconceptions and that these are more likely to be revealed in peer discussion in the learners' main language.

Code-switching as a learning and teaching resource has been the focus of study in mathematics education in the recent past in southern Africa (Arthur, 1994; Adler, 1996; Setati, 1996) and in the United States (Khisty, 1995; Moschovich, 1996, 1999). These studies have shown that use of the learners' first language in teaching and learning mathematics provides the support needed while the learners continue to develop proficiency in the language of learning and teaching.

An interesting study regarding the use of CS in English language classrooms was undertaken by Stein (1994) in a grade seven class at a Gauteng primary school. Together with a research student and the learners, Stein produced a book of multilingual stories, jokes and drawings. She describes how working with all the main languages of the learners facilitated the storytelling and storywriting process:

At the beginning of this project, when I asked the class if they had any stories to tell, or if they could remember any stories from their families or communities, many said that they did not have any stories. Then Patrick Baloyi, a research student from the Department of Applied English Language Studies at Wits, came along and started off the process by telling some of the stories his father used to tell him when he was young. Stories about World War 2, stories about the family history, stories about animals. We said to the children, 'Tell your stories in the language in which it was told to you.' And then suddenly all the stories started coming out! Stories in Zulu, Tswana, English, Afrikaans, Tsotsitaal! So we set up oral storytelling sessions with the whole class and recorded them on video camera. If someone told a story in Xhosa, someone else would translate it into English. In this way we tried to develop the children's skills in translation. Zulu into English. English into Sotho and so on. This is how we built up a collection of more than 30 stories. (Stein, 1994)

The CS foci of these various studies range from misconceptions in science, to sustaining mathematical discussions, to storytelling in English. There is, nevertheless, an underlying common thread in both the motivations for, and the findings of, this growing research field. Exploratory talk is important for learners to explore ideas and concepts in a comfortable environment. It is also important for enabling teachers to listen to learners' ideas and conceptions so that these can be



worked with and built on. Code-switching, and through this the harnessing of learners' main languages as resource, becomes a means in the multilingual classroom for exploratory talk.

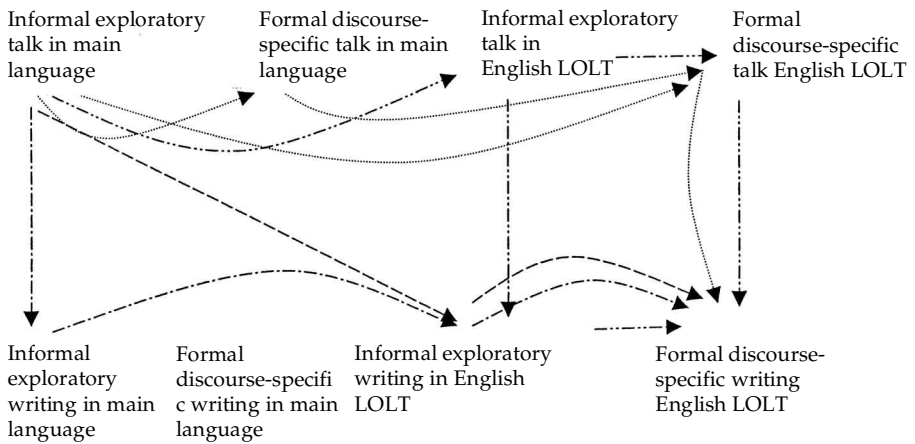
### Discourse-specific talk in the multilingual classroom

It is well known that language is important for thinking and learning. This means that language is not only an issue in bi-/multilingual mathematics, science and English language classrooms but in all classrooms. Language, however, takes on a specific significance in bi-/multilingual classrooms. Learning and teaching mathematics, science and English language in a bi-/multilingual classroom in which the LOLT is not the learners' main language is, undoubtedly, a complicated matter. Learning mathematics and science has elements that are similar to learning a language since these subjects, with their conceptual and abstracted forms, have very specific registers and sets of discourses. This places additional demands on mathematics and science teachers and learners.

As became evident in the first phase of the FDE research project in 1996 (this point is taken further later in this paper), mathematics and science teachers face different kinds of challenges in their bi-/multilingual classrooms from English language teachers. The latter have as their goal, fluency and accuracy in the new language – English. Mathematics and science teachers, in contrast, have a dual task. They face the major demand of continuously needing to teach both the discipline and English at the same time. Learners have to cope with the new language of the discipline as well as the new language in which it is taught (English) (Adler *et al.*, 1997).

What is similar about these three subject areas, mathematics, science and English, is the fact that learners have to be initiated into specific ways of talking. Most learners come into the school with informal ways of talking and the challenge that teachers face is to encourage movement in their learners from predominantly informal spoken language to formal language, both spoken and written. Formalisation takes on different forms in mathematics, science and English. In mathematics and science, informal language can be referred to as the kind that learners use in their everyday lives to express their mathematical or scientific understanding. Formal mathematical or scientific language refers to the standard use of terminology, which is usually developed within formal settings like schools. In most mathematics and science classrooms both formal and informal language are used either in written or spoken form. Pimm (1991), whose work originates in mathematics education, but can be used across mathematics, science and English, suggests that there are two possible routes to facilitate movement from informal spoken language to the formal written language that is frequently more valued in the school learning situation. The first route is to encourage learners to write down their informal utterances and then work on making the written language more self-sufficient; the second is to work on the formality and self-sufficiency of the spoken language prior to its being written down.

In bi-/multilingual classrooms the movement from informal spoken language (exploratory talk) to formal written language (discourse-specific writing) is complicated by the fact that the learners' exploratory talk may be in a



**Figure 1** Possible journeys from informal exploratory talk in the main language to discourse-specific talk in English (adapted from Setati & Adler, forthcoming).

language that is not the learners' LOLT. Figure 1 shows there are different possible routes that can be followed to facilitate the learners' movement from informal exploratory talk in the main language to formal discourse-specific written language in English.

The discussion so far enables us to see complex and competing demands on teachers in multilingual classroom contexts in South Africa. They are to embrace an additive model of bi/multilingual learning, and at the same time deal with the popular demand for access to English. Teachers also need to enable exploratory talk, which invariably needs to take place in learners' main language(s), or in a combination of those languages and the LOLT, constituted by code-switching. At the same time they are to provide learners with access to subject-specific discourses. In particular, they need to assist learners to develop formal spoken and written mathematics, science and language competence in English. The pedagogical and the political are inextricably intertwined in each of these. And in moments of classroom practice, they can pull in competing and contradictory ways.

The outcomes of the FDE research project provide insights into this complex arena of educational practice.

### Code-switching Practices across Classrooms and Contexts

In all three years of the study (1996, 1997 and 1998), researchers recorded the occurrences of CS by the teacher and the learners in each class against particular items in a classroom observation schedule. Observation records were backed up by written narratives of every lesson as well as videotapes of selected lessons. Teachers also spoke about their code-switching practices in their in-depth interview each year. Table 1 presents an analysis of this data in summary form.

**Table 1** Record of codings from observation schedules 1996, 1997, 1998

	Teacher: according to subject, level and language infrastructure	CST: code-switching by teacher			CSL: code-switching by learner		
		1996	1997	1998	1996	1997	1998
Maths	MP1 FLE	1	2	1	1	2	1
	MP2 FLE	1-3	X	2	1	1	1
	MP3 FLE	X	2-	2-	0	2	2
	MP4 FLE	0	0	1	1	2	1
	MP5 ALLE	1	1	1	2	2+	2+
	MS1 FLE	2	2+	2+	1	2	2
	MS2 FLE	2+	2	2+	3	2	2
	MS3 ALLE	2+	2+	2+	2	2+	2
	MS4 ALLE	2	2+	2+	1	3	3
Science	SP1 ALLE	1	2	2	2	2+	2+
	SP2 ALLE	2	2+	2+	2	2+	2+
	SS1 FLE	0	0	2	1	2	2
	SS2 FLE	2	2	2	1	2	2
English	EP1 ALLE	0	1	0	2	2	4
	EP2 FLE	0-1	1	2	1	1	0-1
	ES1 FLE	0	0	0	4	4	4
	ES2 FLE	1	2	3	0	3	3
	ES3 ALLE	0	2	1	0	3	1

MP1 FLE = Mathematics primary teacher 1, in foreign language learning environment  
 ES3 ALLE = English secondary teacher 3, in additional language learning environment

*Code-switching by teacher (CST)*

0 = teacher only uses English in all verbal interactions

1 = teacher occasionally switches from English to main language(s) for reformulation in public and in limited individual/group interactions

2 = teacher switches from English to main language(s) for reformulation in public whole-class teaching, and uses main language(s) as major language of interaction with individuals and small groups

3 = teacher switches between English and main language(s) as necessary for the flow, order and content of teaching in public whole-class teaching and uses main language(s) as major language of interaction with individuals and small groups

X - Teacher not teaching Mathematics during observation period

*Code-switching by learners (CSL)*

0 = learners only use English in all verbal interactions

1 = learners use limited English in public domain (responding to teacher questions, typically short phrases or single words, procedures required); occasionally have opportunity in individual/group interactions to use main language(s) for questions/exploratory talk

2 = use English in public domain (still limited to short responses), with good opportunity for exploratory talk in main language(s)

3 = switch as needed in whole-class interactions; use main language for exploratory talk

4 = switch as needed in whole-class interactions; use main language for exploratory talk and English for reporting on work done in public domain

Our main findings are described and discussed in terms of:

- changes in code-switching practices of teachers and learners over the three years of the study;
- teachers' views on code-switching<sup>4</sup>;
- differences across teaching and learning contexts;
- differences across subjects.

### Changes to code-switching practices, 1996–1998

Code-switching by both teachers and learners was observed during the base-line study in 1996, particularly in mathematics and science classes, and thus was an already established practice of the teachers in the study as they entered the FDE programme. The table shows that, in general, the extent of switching increased over 1997 and 1998. The form CS took in most classrooms was as follows: in the public domain, teachers used English predominantly and they switched to learners' main language(s) for reformulation in public whole-class teaching, and for interaction with individual learners or small groups. Learners also mainly used English in the public domain. In many classrooms this spoken English was limited to short phrases, single words or recall of procedures, but in 1997 and 1998 learners engaged in more exploratory talk in their main language(s) than had been observed in 1996. This increased 'learning talk' in many of the lessons was related to many of the teachers incorporating more group work in their practice.

In fact, the most visible change that we saw over the three years was the increase in group work across most classes (Adler *et al.*, 1999). Learners had more discussions with each other in their groups or in pairs in their main language, or in their main language and English, creating more possibilities of learning from talk in many classrooms. However, group work as it occurred across many of the classrooms and the accompanying harnessing of learners' main language(s) as a learning resource and thinking tool suggested some unintended consequences.

In some English classrooms there was a significant increase in oral work, and in the ability of learners to use English for extended speaking turns when addressing the whole class. However, a structured analysis of learners' classworkbooks indicated that increased oral work was accompanied by limited writing of extended texts in English. Exploratory talk seemed to feed a practice that undermined writing.<sup>5</sup> In most of the maths and science classes, there were few opportunities for learners to report on their group work, and written work was restricted to exercises, typically in symbolic form. There were also few opportunities for learners to use and develop spoken and written English. In the science classes in particular such language was used mainly by the teacher. SP1 and SP2, and MP5 (see explanatory notes to Table 1) all organised learners to work in groups on science experiments and more open mathematical tasks respectively. In each of these classrooms, learners engaged with each other in their main languages while working on a mathematical task (e.g. exploring tessellating shapes) or on an experiment in science (e.g. exploring magnetic substances). However, the movement from this exploratory talk was often directly to exposition by the teacher, typically in English, or to written worksheets in English. In summary, across English, mathematics and science

classes the journey that needed to be navigated from learners' informal, exploratory talk in their main language to formal, discourse-specific talk and formal written work in English appeared to be incomplete.

We had not set out in the research to explore the journey from exploratory talk in the main language to discourse-specific talk and writing in English. Our understanding of the journey, and our observations that it appeared to be incomplete, particularly as more group work entered classroom practice, emerged as the research unfolded, and most noticeably in the final year of data collection. We thus did not collect systematic data of changes in learners' productions, either in classroom discussion or in written texts over time. As a result, the data we have does not enable us to make substantive claims beyond noting an incompleteness in the journey travelled, nor about possible consequence for learners. However, we speculate that it is likely that in mathematics and science, the *meanings* of the formal concepts and/or symbols they came to write down were not sufficiently elaborated through more explicit moves from informal talk to discourse-specific talk. In English, possibilities for learners to develop spoken and written discourse-specific English language skills were limited.

### Teachers' views on code-switching

On the one hand, many of the teachers talked about how their FDE studies gave them more confidence in using code-switching. An established practice was legitimated through their engagement with language practices in the programme. In her first interview in 1996, MS1 told us that 'before I joined the FDE I thought it's a mistake to talk in Tsonga in the maths class . . .'. Similarly, MS2 said that 'Learners understand better [when she uses Tsonga]. I used switching even before, but I got confidence to use code-switching from the course' (MS2, interview, 1998). In the words of two of the English language teachers, the FDE 'liberated' them with regard to code-switching. This is significant in the light of the politics around English as target language and how this is best acquired, suggesting that the approach in the FDE programme works as support for current language in education policy in a hotly contested political terrain.

On the other hand, many teachers also expressed a number of dilemmas in relation to access to meaning and access to English. As they talked about CS in their interviews, they justified their own and their learners' use of main language in ways that indicated that they believed that CS really should not happen, but that they had no alternative to making use of it. Switching was needed for understanding concepts or ideas, and for communicating these understandings:

Ever since [teaching] Standard 10 [Grade 12] I have done that [code-switched] because sometimes when I talk to them [learners], I look at their face and I could see they don't hear any word. So I try to switch to Northern Sotho. This is something that I have even told my Standard Sixes [Grade 8], that there is maybe something you want to say, if you find you can't find the words in English, just say it in Northern Sotho. (SS2, Interview, 1998)

MS1, a secondary mathematics teacher in an FLLE school in the Northern Province, demonstrated increased use of CS in 1997 and 1998 for reformulation in the public domain and during interaction with individuals and small groups.

In her 1997 interview, she offered the well-rehearsed argument for teaching in English: 'Teachers should use English because the exams are in English'. By 1998 she was able to articulate some comfort with her CS by referring to how it is used:

Code-switching is good only when it is used properly . . . I mean if you just allow your students to use just Tsonga they just talk, talk, talk Tsonga too much . . . but maybe if you ask a question and you see that a child is struggling to say something properly in English, but maybe he has got some ideas, if you allow your students to talk in Tsonga it helps. You find that he has got brilliant ideas or the answer you wanted or something like that or the misconception . . . after you have code-switched to Tsonga, you can repeat that thing in English. Or maybe if one child answers in Tsonga, you can repeat in English for the others . . . to show them that it's important that they try and use this language because they read question papers in English. (Interview, 1998)

Signalled here is the 'dilemma of code-switching' described by Adler (1998) in her study of secondary mathematics teachers' knowledge of their practices in multilingual classrooms. Teachers who are themselves multilingual, whose learners know that they can reformulate and converse with them in their main language, are continually judging when to switch from English so as to enable learners to make sense of the concept or topic under discussion. At the same time they are continually judging when to push learners' reception and production of mathematics in English, since this, ultimately, is the language in which learners will be assessed. English as target language has to be acquired through and during the learning of mathematics. The dilemma between access to meaning and access to English is ever present, having to be managed ('used properly') in the day-to-day practices in multilingual mathematics classrooms in South Africa.

A discussion of code-switching and the formation of identity is beyond the scope of this paper and particularly beyond what was present in the data. The significance of code-switching for engagement with issues of self in varying ways was, nevertheless, signalled by one of the English teachers. ES3 is clear that as an English language teacher, she needs to work in English. However, there are times when it is necessary for her to work in the learners' main language(s).

At times there is something that when you explain in English, they seem to understand. But if you tell it in vernacular they seem to understand it better. Maybe if you instill some morals, if you say it in English it becomes at times light, they take it and just joke. But if you express it in mother tongue, they get the feel of it. (ES3, Interview, 1997)

The shifts to more code-switching by teachers and learners observed and summarised in Table 1 are intentional, if dilemma-filled, though there is a relative silence around issues of identity in teachers' motivations and justifications for code-switching. Moreover, the teachers do not express an awareness of the demands on them to steer their learners towards increasing discourse-specific talk in English in the classroom. In the struggle with and for English as LOLT, and the legitimating of code-switching practices, what is signalled in this study is that strategies that enable exploratory talk in the main language are fairly easily

		<i>Teacher</i>			
		0	1	2	3
<i>Learner</i>	0	ES3	ES2		MP3
	1	MP4 EP2 SS1	MP1 MP2	MS1 MS4 SS2	
	2	EP1	MP5 SP1	SP2 MS3	
	3			MS2	
	4	ES1			

Figure 2 Grid showing teacher and learner code-switching (1996)

		<i>Teacher</i>			
		0	1	2	3
<i>Learner</i>	0				
	1		EP2		MP2
	2	MP4 SS1	MP5 EP1	MP1 MP3 SP1 SP2	MS1 MS2 MS3 SS2
	3			MS4 ES2 ES3	
	4	ES1			

Figure 3 Grid showing teacher and learner code-switching (1997)

		<i>Teacher</i>			
		0	1	2	3
<i>Learner</i>	0				
	1		MP1 MP4 ES3	MP2 EP2	
	2		MP5	MS1 MP3 SP1 SP2	MS2 MS3 SS1 SS2
	3			MS4	ES2
	4	EP1 ES1			

Figure 4 Grid showing teacher and learner code-switching (1998)

appropriated by teachers. But this appropriation is not easily coupled with equal attention to discourse-specific talk in English on the one hand, and extended formal writing in English on the other.

### Differences across teaching and learning contexts

One of the difficulties encountered in working across teachers, however small the sample, is that patterns across conceal divergences and important differences within and between. What the teachers' views begin to reveal is how the 'average', or overall pattern of increased use of CS conceals important differences across subjects, across levels, and across regions. Here is where the detail available to us through case studies enabled us to identify some of the complexities that constitute these differences.

Differences between the CS practices of primary and secondary mathematics teachers are evident in Table 1. They can be seen in a different display in Figures 2, 3 and 4 which position each teacher in a grid relating teacher and learner switching in each of the years 1996, 1997 and 1998. In Figure 2, there is a dispersion of the teachers across the grid, a dispersion that begins to converge in 1997 and continues to do so in 1998. In relation to level and context, there is an interesting phenomenon across the nine mathematics teachers. Teachers and learners in the secondary mathematics classrooms observed made greater use of CS than those in primary mathematics classrooms. This observation surprised us during the first year of the study, and its persistence required further examination. We had in fact anticipated the reverse. In the primary school where levels of competency in English as additional language could be expected to be poorer than at secondary level, we expected teachers to use learners' main language more frequently themselves and have their learners do so.

This 'level' observation nevertheless intersects with context in an important way. Four of the five primary mathematics teachers were in rural FLLE contexts, with minimal English language infrastructure. That English was more prevalent in these primary FLLE mathematics classrooms can be understood as teachers seeing it as their task to model and encourage English and mathematical English. The classroom is the only context in which learners have this exposure. And the teacher is possibly the only source for this, hence the pressure to use English as much as possible. The double irony here is that in the very context where learners' main language is their only route to exploratory talk, there are the greatest pressures on the teacher to use English as much as possible, and at the same time to maximise learners' use of English in the classroom.

That there are different demands on teachers at different levels and in different language infrastructural contexts was reflected in the ways teachers talked about their code-switching. While the dilemma of code-switching was expressed in some form by all teachers, it was far more acute for primary than secondary school teachers, particularly in mathematics and science. Primary mathematics and science teachers carry the responsibility, together with the English language teachers, for *establishing* fluency in English while they are teaching their subject. The dilemma was also more acute for teachers in rural FLLE schools than it was for teachers in urban ALLE schools. MP1, a primary school mathematics teacher in an FLLE context, whose practice shifted from no switching in 1996 to limited switching in the public domain in 1998, expressed contradictory views about her



own switching as a teacher which illustrate her dilemma. In 1997 she said: 'I use code-switching because learners do not understand English'. In 1998, she was equally adamant that 'Code-switching does not benefit learners'. MP1's ambivalence explains why teachers like her are seen to switch minimally, and are also not seen encouraging learners' use of their main language in formal class time.

In FLLEs, the school is likely to be the only place where most learners can hear English being spoken. Teachers are faced with the challenge that even if learners do not understand English, they need to provide maximum opportunity for these learners to hear and use English.

### Differences across subjects

The mathematics and science teachers in the study, particularly those working in secondary schools, switched to the learners' main language to reformulate concepts, ideas and instructions. SS2 explained his CS practice as follows:

Sometimes I ask them a question, and they keep quiet, all of them. I have to rephrase the question and still . . . and I try to lead them to an answer. (1997)

MS3 explained how important it was that learners draw on their main language in their mathematical learning:

It is easier for them to ask questions if they use their mother tongue. They become more free. It is easier for them to explain exactly what they want. (1998)

While present, switching was a *minor part* of English language lessons. EP1 and ES1 switched least, and ES1 did not switch at all. By 1998, their learners switched as needed, used their main language for exploratory talk and were encouraged and able to report on work in the public domain in English. These English teachers enabled learners' use of their main language as a resource for learning talk – for both exploratory and discourse-specific talk. They themselves scaffolded English rather than switched.

EP1 explained in her interview that she switched into TshiVenda only 'as a last resort'. This would be to clarify an instruction or explanation or to respond to learners' queries during individual or group work.

If learners do not understand a word in a comprehension passage I say look at the dictionaries. You find that even if they look in the dictionary, they do not understand. I tell them in Venda, it means this. (Interview, 1997)

Interestingly, this view about CS only holds for her in her English language class. She commented that when she taught other subjects she switched more – as indeed was observed in her teaching of health lessons.

ES1 used only English in the public domain in his class. As noted by one of his observers: 'He reworks the meaning of the word through the generation of multiple sentences in which the word is used, all the while linking the meaning of words to students' experiences' (Lesson observation commentary, 1996). In his interview in 1998, he explained that his 'students have limited chances of getting their vocabulary (in English) enriched' and so it is very important for teachers to speak English and provide a model for learners.

Both EP1 and ES1 were, nevertheless, effective in harnessing learners' use of their main language. In most of the English classrooms, learners were encouraged to switch for exploratory talk. ES1 said:

It's much easier for them to talk so long as I don't go to them and listen to the type of language they are using. Because if you are still constructing a picture and then I want you to paint it in English, then it's much more difficult. But when they are using their mother tongue it's quite easy. They come up with ideas and then the battle will obviously be the presentation. But as long as they are making sense I am okay with that. (1998)

and EP1 said:

If there's someone, maybe he is not able to speak the sentence in English, she can make some code-switching. But not always. You must speak . . . maybe the sentence in English and then you put the Venda words. The group will help you. Or you can say the whole sentence and the group must tell you the sentence in English. I ask them to code-switch. (Interview, 1998)

That mathematics and science teachers switched more in the public domain than English language teachers thus emerges as a clear function of their differing primary goals. The primary goal in the English language class is the acquisition and learning of English. We have been persuaded by these two English teachers in particular, how important it is in the first instance, to distinguish between teachers' and learners' use of main languages in the classroom. Moreover, in contexts with limited English language infrastructure, the teacher's role in modelling and scaffolding the use of English is critical.

In much of the literature on models of bilingual and multilingual teaching there are generalised claims for the harnessing of learners' main language as a resource in the teaching-learning process, and for switching to be part of both teacher and learner talk. The practices and views across the mathematics, science and English language teachers in this study enable us to see that more research is needed that distinguishes teachers' and learners' switching needs in relation to the subject learning at hand. As mentioned earlier, in our focus on teachers in this study, we did not interview learners on their views of code-switching, and our attention to learners' language practices was in relation to our focus on the teachers. Clearly, for full accounts of teaching and learning needs across subjects, further research needs to include focused attention on both teachers and learners.

### **Implications of the Research Findings for the FDE Programme, for Educational Policy in South Africa and for INSET in General**

One of the most significant things we have learned through this research project is just how complex language issues are in rural schools where there is very limited English infrastructure in the surrounding community for teachers to build on in school. Exposure to English is via the teacher. This puts pressure on teachers to use English as much as possible. Teachers in rural schools in this study, particularly across Grades 7 to 9, argued quite strongly against frequent code-switching in class. We also found that primary maths and science teachers

in urban and rural schools feel far more pressure than their secondary colleagues to teach in English because their learners are still in the early stages of learning English.

Across all the teachers, the dilemma of code-switching persists, and with it issues of meaning, of self and of access to English, the dominant and most powerful language in the country. So what does this mean for the FDE programme at the University of the Witwatersrand, for educational policy in South Africa and for INSET more generally?

At the level of the FDE programme, it is critical that we pay more explicit attention to possible journeys from exploratory and informal talk in the main language towards discourse-specific talk in English and formal writing in English. Moreover, attention needs to be given to the ways and means by which these journeys are likely to differ across contexts. In concluding her study, Adler (1998) argues that cases built around key dilemmas in multilingual classrooms (like code-switching) could be a means for enabling teachers to engage critically and substantively with complex demands in South African multilingual classrooms. In the English language classroom teachers need to grapple with cases or instances where the dilemma of switching is apparent. An example here would be reading, speaking and writing about an emotive text. ES3 suggests that emotive meanings, meanings tied to self, are unlikely to be revealed or accessed in English. A case could be built that explores how to move from informal discussion in main language(s) to speaking and then writing about the text in English. As Figure 1 shows, there are many routes for this pedagogical journey – but it needs to be navigated.

While on the surface, reading, speaking and writing mathematics and science might be less emotive (we suggest that emotions are always present in the classroom, but they might not be the explicit focus of attention as in an English text), a similar journey from informal talk in main language to formal written productions is necessary. For mathematics teachers, a case that throws up the dilemma as mathematics teachers deal, for example, with a concept that has no immediate translation into the learners' main language, could be interesting. Here the teacher is required to either scaffold within English or draw on metaphors and other meanings in the main language, and then navigate the journey between these and the formalisation of the concept in spoken and written forms. The case could highlight the kinds of difficulties learners and teachers might confront on such a journey; and it could also highlight the kinds of routes that teachers and learners do navigate.

In short, the FDE courses and programme as a whole need to attend more explicitly to instances of practice (practice-based learning in Lampert and Ball's (1998) terms) which are both images of what the journeys could be, and which consider why and how these journeys might create tensions for teachers and learners.

At the level of educational policy in South Africa, findings from our research suggest that some of the dominant 'messages' in current curriculum documents may need to be reviewed. For example, one of these messages in Curriculum 2005 is that group work is 'good' as it encourages exploratory talk and cooperative learning. The issue of how teachers and learners are to navigate the journey from informal exploratory talk (in the learners' main and/or additional

languages) to formal, discourse-specific talk in English is not addressed. As a second example, language in education policy that supports additive bi/multilingualism in classrooms aggregates all schools and does not sufficiently consider the differing language infrastructures of schools and communities.

At the level of INSET, different language infrastructures, levels and subjects in and with which teachers work appear to be significant for shaping INSET possibilities and constraints. We would not be overstating the case to say that across national contexts, increasing emphasis on learner-centred practice is widespread (e.g. Black & Atkin, 1996), as is advocacy for additive models of bilingual education, within which CS is a key strategic practice (JET, 1997). Advocacy of learner-centred practice, of additive bi/multilingualism and of strategic code-switching are features of the courses in the FDE programme. What we have shown from our study of FDE teachers in multilingual contexts is that firstly, take up of these practices was evident across contexts, but also attenuated across contexts. Code-switching practices facilitate the harnessing of learners' main languages and so exploratory talk in the classroom. At the same time, however, there are unintended consequences of the increasing exploratory talk in class, with teachers either short-cutting or not completing the journey from informal exploratory talk in the main language to formal discourse-specific writing in English. This suggests the need for more serious engagement in teacher education with the possibilities of, and constraints on, what are typically presented as panaceas for 'good practice'.

That all the teachers in the FDE study expressed some form of dilemma in relation to code-switching, and that these dilemmas were most acute in FLLE and primary school contexts is support for research literature recently emerging from what are called ESL (English Second Language) contexts elsewhere. In two independent articles reporting research in science and mathematics reform classrooms in the USA, Fradd and Lee (1999) and Moschovich (1999) each question whether and how group work and a more facilitative and less instructive role for the teacher actually promote equity goals. In their shared concern for developing discourse-specific talk and competence in learners of mathematics and science, they ask whether so-called universal 'good practices' actually deny rather than enable learning in ESL contexts.

In their report on a study of science classrooms, Fradd and Lee (1999) pose the question: does the total move from whole class to small group work benefit ESL learners? They argue that learning science is dependent on the learners' ability to comprehend and communicate concepts and understandings. Learners need to develop the language to question, inquire and explore, i.e. they need to acquire the discourse of school science. They go on to argue that the indirect nature of exploratory talk (in groups) makes it difficult for learners to acquire these specific participation rules on their own, and as a result, a fully exploratory science classroom learning environment may limit, rather than enhance, learners' opportunities to learn. Fradd & Lee argue that learners could benefit from both explicit teacher-led activities and from exploratory teacher-facilitated activities. They advocate a research agenda to effectively implement science inquiry in ways that would enable all students to succeed, where teachers need to link the nature of science with learners' experiences and interactional styles.

Moschovich (1999) addresses this very issue, but specifically in relation to teaching and learning mathematics in ESL contexts. Starting from the assumption that teachers need to support the participation of ESL learners in mathematical discussions, she argues for the kinds of strategies observed in the classrooms of the two English language teachers discussed earlier in the paper (ES1 and EP1). She shows, through a case study of a teacher, how mathematical discussion is facilitated by the teacher using several expressions (in English) for the same concepts, using gestures and objects to clarify meaning, accepting and building on learners' responses in English, 'revoicing' learners' statements using more formal maths language (again in English), and focusing not only on vocabulary but also on maths content and argumentation practices. She too poses the question: does the total move from whole class to small group work benefit ESL learners? Her research suggests that the answer here is 'no'.

## Conclusion

We learned from the teachers in this study that their code-switching practices are intentional but dilemma-filled, particularly in the face of the dominance of English in the South African context. Attention to code-switching in INSET can be an important part of a process of legitimising what teachers actually do (i.e. harness learners' main language as a resource for learning) in a context where pressure to access and acquire English is enormous.

The widespread 'take-up' by most teachers in the study of forms, such as group work, that increase the possibilities of learning from talk (i.e. of learners using language as a social thinking tool) indicates that this practice is easily integrated – at least in form – into existing teaching and learning repertoires. However, learning from talk is significantly limited if it is not supported or complemented by strategies for learning to talk, i.e. learning subject-specific formal or educated discourses. There appears to be a danger that the advocacy of talking to learn and use of main languages is being incorporated or taken up at the expense of learning to talk mathematics or science. In the English language class it may also be at the expense of writing extended texts.

As previously stated, the different English language infrastructures, levels and subjects in and with which teachers work appear to be significant for shaping INSET possibilities and constraints. We need to dis-aggregate schools and classrooms along these three different axes and tailor programmes according to whether they are within English Foreign Language or English Additional (Second) Language infrastructures; whether they are primary or secondary; whether they are about language as subject or language for a subject. Our concern is that without such specific contextual attentions, we will only exacerbate educational inequalities and leave some teachers and learners 'stranded' at some point on their educational journey.

## Correspondence

Any correspondence should be directed to Professor Jill Adler, Chairperson Mathematics Education Development, Department of Mathematics, University of Witwatersrand, Private Bag 3, Wits 2050, Johannesburg, South Africa (036ja@cosmos.wits.ac.za).

## Notes

1. This paper is the product of ongoing work of a larger research team: J. Adler, A. Bapoo, K. Brodie, H. Davis, P. Dikgomo, T. Lelliott, Y. Reed, T. Nyabanyaba, K. Setati, L. Slonimsky.
2. In general, ages of learners in Grades 1–7 are between 6 and 13, and of learners in Grades 8–12 are between 13 and 18. However, there remain significant numbers of overaged learners across grades, particularly in rural schools. For example, in some of the rural schools we worked in there were 18-year-old learners in Grade 7.
3. These are two of the nine provinces in South Africa. Gauteng is the industrial hub of the country, largely urban and one of the richer provinces. In contrast, the Northern Province is predominantly rural and poor. Conditions in schools across the two provinces vary enormously.
4. Due to our focus on teachers' practices, we did not interview learners to ascertain their views on code-switching.
5. With our focus in the study on teachers' practices, we did not set out to record in any detailed way learners' language production, particularly their written work. This emerged as important over time, and we attempted to capture this through careful analysis of learners' classwork books, particularly in the final year.

## References

- Adler, J. (1996) Secondary teachers' knowledge of the dynamics of teaching and learning mathematics in multilingual classrooms. PhD dissertation, University of the Witwatersrand, Johannesburg.
- Adler, J. (1998) A language of teaching dilemmas: Unlocking the complex multilingual secondary mathematics classroom. *For the Learning of Mathematics* 18, 24–33.
- Adler, J., Lelliott, T. and Slonimsky, L. with Bapoo, A., Brodie, K., Reed, Y., Setati, M., Mphunyane, M., Nyabanyaba, T., Van Voore, M. and Davis, H. (1997) *A Baseline Study: Teaching and Learning Practices of Primary and Secondary Mathematics, Science and English Language Teachers Enrolled in the Wits Further Diploma in Education (Report)*. Johannesburg, South Africa: University of the Witwatersrand.
- Adler, J., Lelliott, T. and Reed, Y. with Bapoo, A., Brodie, K., Dikgomo, T., Nyabanyaba, T., Roman, A., Setati, M., Slonimsky, L., Davis, H. and De Wet, H. (1998) *Mixed-mode FDEs and their Effects: An Interim Report on the Teaching and Learning Practices of Primary and Secondary Mathematics, Science and English Language Teachers Enrolled in the Wits Further Diploma in Education (Report)*. Johannesburg, South Africa: University of the Witwatersrand.
- Adler, J., Bapoo, A., Brodie, K., Davis, H., Dikgomo, P., Lelliott, T., Nyabanyaba, T., Reed, Y., Setati, M. and Slonimsky, L. (1999) *Mixed-mode Further Diplomas and the Effects: Summary Report on Major Findings of a Three Year Research Project*. Johannesburg, South Africa: University of the Witwatersrand.
- Adler, J. and Reed, Y. (2000) Researching teachers' 'take up' from a formal in-service professional development programme. *Journal of Education* 25, 192–226.
- Apple, M. (1988) *Teachers and Texts*. New York: Routledge.
- Arthur, J. (1994) English in Botswana primary classrooms: Functions and constraints. In C.M. Rubagumya (ed.) *Teaching and Researching Language in African Classrooms*. Clevedon: Multilingual Matters.
- Auerbach, E.R. (1993) Reexamining English Only in the ESL classroom. *TESOL Quarterly* 27 (1), 9–32.
- Bassey, M. (1999) *Case Study Research in Educational Settings*. Buckingham: Open University Press.
- Baker, C. (1993) *Foundations of Bilingual Education and Bilingualism*. Clevedon: Multilingual Matters.
- Barnes, D. (1992) The role of talk in learning. In K. Norman (ed.) *Thinking Voices*. London: Hodder and Stoughton.
- Black, P. and Atkin, M. (eds) (1996) *Changing the Subject: Innovations in Science, Mathematics and Technology Education*. London: Routledge.

- Bourdieu, P. (1991) *Language and Symbolic Power*. Cambridge, MA: Harvard University Press.
- Department of Education (1997) *Language in Education Policy*. Pretoria: Department of Education.
- Department of Education (1999) *Language-in-Education Implementation Plan*. Pretoria: Department of Education.
- Fradd, S. and Lee, O. (1999) Teachers' roles in promoting science inquiry with students from diverse language backgrounds. *Educational Researcher* 29 (5), 14–20.
- Grosjean, F. (1985) The bilingual as a competent but specific speaker-hearer. *Journal of Multilingual and Multicultural Development* 6 (6), 467–77.
- Joint Education Trust (JET) (1997) Teaching in multilingual classes: A report of a literature survey commissioned by the Joint Education Trust. *President's Education Initiative: Appendix C*. Johannesburg: Joint Education Trust.
- Khisty, L.L. (1995) Making inequality: Issues of language and meanings in mathematics teaching with Hispanic students. In W.G. Secada, E. Fennema and L.B. Abajian (eds) *New Directions for Equity in Mathematics Education*. Cambridge: Cambridge University Press.
- Lampert, M. and Ball, D. (1998) *Teaching, Multimedia and Mathematics: Investigations of Real Practice*. New York: Teachers' College Press.
- Mercer, N. (1995) *The Guided Construction of Knowledge: Talk Amongst Teachers and Learners*. Clevedon: Multilingual Matters.
- Moschkovich, J. (1996) Learning mathematics in two languages. In L. Puig and A. Gutierrez (eds) *Proceedings of the Twentieth Conference of the International Group for the Psychology of Mathematics Education* (vol. 4) (pp. 27–34). Valencia: Universitat De Valencia.
- Moschkovich, J. (1999) Supporting the participation of English language learners in mathematical discussions. *For the Learning of Mathematics* 19 (1), 11–19.
- NEPI (1992) *Language*. Cape Town: Oxford University Press.
- Pimm, D. (1991) Communicating mathematically. In K. Durkin and B. Shire (eds) *Language in Mathematical Education*. Milton Keynes: Open University Press.
- Ringbom, H. (1987) *The Role of the First Language in Foreign Language Teaching*. Clevedon: Multilingual Matters.
- Rollnick, M. and Rutherford, M. (1996) The use of mother tongue and English in the learning and expression of science concepts: A classroom-based study. *International Journal of Science Education* 18 (1), 91–103.
- Saunders, G. (1988) *Bilingual Children: From Birth to Teens*. Clevedon: Multilingual Matters.
- Setati, M. (1996) Code-switching and mathematical meaning in a senior primary class of second language learners. M Ed research report, University of the Witwatersrand, Johannesburg.
- Setati, M. and Adler, J. (forthcoming) Between languages and discourses: Codeswitching practices in primary classrooms in South Africa. *Educational Studies in Mathematics*.
- Stein, P. (1994) *Our Stories in Our Languages*. Johannesburg: Department of Applied English Language Studies, University of the Witwatersrand.
- Taylor, N. and Vinjevd, P. (1999) *Getting Learning Right*. Johannesburg: Joint Education Trust.
- Wells, G. (1992) The centrality of talk in education. In K. Norman (ed.) *Thinking Voices*. London: Hodder and Stoughton.