Linguistic discrimination and mathematics education research

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The presence of many languages in our society and our classrooms has implications for conducting research, both in terms of the validity of the research and the broader social responsibilities of the mathematics education research community. In this paper, I argue that in some ways mathematics education research causes or reproduces the educational and social disadvantage of researchers, teachers and students of less favoured languages. Two conference papers reporting research into multilingual issues in mathematics teaching and learning are examined as a way of considering such issues in more detail. Brief suggestions are offered for a way forward.

Introduction

How many languages do you speak? When and where can you use them? The language or languages we use are determined by a combination of choice, upbringing and social necessity. The different ways in which we use these different languages is in part related to our multiple roles within society and to our ethnic, religious, social or cultural identities. Even if we see ourselves as monolingual, we live in multilingual societies; many languages are used around us, perhaps increasingly so with the advent of global communication. Although the question of which languages are used in our classrooms is an important educational issue, decisions about the role of different languages in education are largely political (Edwards, 1994; Paulston, 1999). Who gets to use which languages in schools, as in wider society, is closely bound up with issues of access, power and dominance. So members of minority language groups, for example, must learn the majority group language to participate in formal education. In this way minority languages may be devalued and speakers of such languages potentially disadvantaged. Differential opportunities, attitudes or treatment of speakers of minority languages, including school students, can be seen as a form of discrimination. The sociolinguist Tove Skutnabb-Kangas characterises such discrimination, which she terms *linguicism*, as:

> ideologies and structures which are used to legitimate, effectuate and reproduce an unequal division of power and resources (both material and non-material) between groups which are defined on the basis of language (on the basis of their mother tongues). (Skutnabb-Kangas, 1988: 13)

Thus a structural expectation within education systems that students from minority groups should only be taught subjects such as mathematics through a majority or dominant language can be seen as a form of discrimination, especially since there is evidence that educating students partly or entirely through their mother tongue is educationally advantageous (Cummins, 1996, 2000). In Skutnabb-Kangas' terms discrimination arises from "ideologies and structures", and occurs through institutional practices and the social construction

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of the dominance of particular languages as much as through the actions of individuals (Skutnabb-Kangas and Phillipson, 1995). Both individual actions and social structures are based on sets of often tacit assumptions about languages, their status and about the people who use them. It is these sets of assumptions which form the basis of ideology (Fairclough, 1989). As individuals we act within the structures of our institutions and of wider society, perhaps unaware that we may be reproducing disadvantage and discrimination.

Linguistic discrimination is an important issue in mathematics education research for several reasons. Firstly, the community of mathematics education research is part of wider society and as such has a responsibility to promote equity and social justice. If research in mathematics education reproduces discriminatory values, it serves to legitimate linguistic discrimination in classroom practice and education policy. A second reason concerns the possible effect linguistic discrimination may have on the body of work produced in mathematics education research. If some languages are favoured over others within our community, we privilege some ways of making sense of the world whilst ignoring others. Third, linguistic discrimination may affect the validity of our research. If we fail to take account of the multilingual nature of our classrooms and our society the claims we make about the teaching and learning of mathematics are weakened.

This paper seeks to consider how research in mathematics education may reproduce the “unequal division of power and resources” (Skutnabb-Kangas, 1988) both within the community of researchers and in the practice of research. The following questions are addressed: Do the structures and practices of our community privilege speakers of some languages over others? What assumptions about languages do we make in our research? Do the assumptions we make or the practices we enact reproduce disadvantage or discrimination? If so, how can this be addressed? In exploring these questions I seek to uncover some of the assumptions and conventions which make up the discriminatory ideologies and structures of our community and therefore to promote discussion, awareness and change. The paper proceeds by first considering some aspects of the mathematics education community. I next consider the practice of research in mathematics education by examining two published conference papers. In the final section I offer some brief suggestions for a way forward.

The mathematics education research community

This section deals with the activities and practices of the community of researchers who investigate and identify themselves with issues in mathematics education. I will consider two of the main activities of the mathematics education research community: organising opportunities for discussion such as conferences and symposia and the publication of research in research journals and books.

The majority of international conferences in mathematics education appear to be conducted in English. The annual meeting of the International Group for

the Psychology of Mathematics Education (PME) for example, only accepts papers written in English, although it permits the inclusion of an abstract in a second language (PME, 2000). Similar conditions apply to conferences of European Research in Mathematics Education (ERME, 2000) and to the conferences on Mathematics Education and Society (MES, 2001). As with conferences, the leading international journals in mathematics education generally publish in English, although some will also publish articles in other languages, such as French. Book publications probably show greater linguistic diversity than journals. Even here, however, the number of languages in which mathematics education research is published is small compared to the number of languages used in mathematics classrooms, or the number of languages used in the world (several thousand). Furthermore, the few languages in which significant amounts of research are published are arguably the 'powerful' languages of the world and mostly European. How much research is published in widely used languages such as Arabic, Chinese, Hindi, KiSwahili? How much in less widely used languages, such as Quechua, Ute, Uzbek, Nepali, Maori, Sesotho? It is notable that in a number of recent encyclopaedic summaries of international research in mathematics education (e.g. Bishop *et al*, 1996; Grouws, 1992), non-English language research is cited much less frequently than research published in English. The privileging of English (and other European languages) in this way is presumably justified pragmatically. English is the language of academia and, it is argued, it would be impractical to organise international conferences or journals with many different languages. Nevertheless, researchers from English speaking backgrounds have a great advantage. As an English speaker myself, I am aware that writing and reading research for an international audience is more straightforward than for many of my colleagues for whom English is an additional language. Similarly, I have an advantage in presenting my work at international conferences and in the discussions that follow my own or other colleagues' presentations. It ceases to be remarkable how many researchers work in additional languages. The use of English makes it possible for me and my English speaking colleagues to *not* learn to work in other languages.

Does this matter? The privileging of English and a few other languages has at least two consequences. Firstly, as discussed above, a preference for European languages in general, and English in particular, leads to the privileging of research published in those languages, especially English. There is no reason why research published in English is academically better than research conducted and published in any other language. This situation, which is legitimated by the structures and practices of the research community, gives an advantage to researchers who have English (or to some extent other European languages) as a mother tongue. Co-incidentally, these are the languages of many of the more powerful, wealthy nations of the world. Secondly, language is more than a code for ideas which can be translated easily into any other language. Language is part of and emerges from culture, including ways of seeing,

arguing, reasoning, questioning and making sense of the world, as well as academic and philosophical traditions. By privileging a small minority of languages, we favour some ways of making sense of the world over others. Again, the cultures that prevail are those of the powerful, wealthy nations. Ironically, speakers of less favoured languages must by necessity learn more favoured languages, giving them access to different ways of seeing, and an understanding of what that might mean. If these insights must then be communicated in English, however, their richness is lost. Thus some aspects of the community of mathematics education research are linguistically discriminatory. The next section deals with the same issue in the practice of our research by considering two published research reports as case studies.

The practice of research in mathematics education

My first observation is that the language(s) of mathematics teaching and learning are considered relatively rarely. 'Language and Mathematics' is commonly one of the headings used in categorising research (see for example, Bishop et al, 1996; Grouws, 1992; Owens and Mousley, 2000). Much of this work, however, concerns aspects of monolingual classroom interaction or mathematical language. There is little which addresses questions of multilingualism (including bilingualism) in the teaching and learning of mathematics. Given the prevalence of students learning mathematics through an additional language in most parts of the world, whether in immigrant communities or indigenous minorities, it is surprising that there is not more research investigating the many issues this raises for teachers and learners. An explanation may be that the majority of research in mathematics education takes place in the North ('developed countries'), countries which are often portrayed as linguistically homogenous (though this is not at all the case), whilst multilingualism tends to be seen as more of an issue for the Southern countries ('developing countries') which are also those countries with fewer resources to devote to educational research.

Where research has been conducted into issues of multilingualism in mathematics teaching and learning, it generally falls into two main groups: quantitative, outcomes based research (e.g. Dawe, 1983, Clarkson, 1991a, 1992; several studies in Cocking and Mestre, 1988; see also Secada, 1992) and qualitative, classroom based research (e.g. Adler, 1999, 2001; Setati, 1998; Moschkowich 1999; Barwell, 2001). I have selected two research reports to serve as case studies, one from each of the two broad approaches mentioned above. By considering two papers which *do* address multilingualism in mathematics education, I raise issues and questions of relevance for all research into the teaching and learning of mathematics. From the quantitative approach, I have selected Clarkson and Dawe (1997) and from the qualitative, Adler (1995). Both are taken from PME proceedings and both report work by researchers who have published several papers and articles on multilingual issues in mathematics education (e.g. Clarkson, 1983, 1991a, 1992, 1996; Dawe, 1983; Adler, 1997,

1998, 1999) including two monographs (Clarkson, 1991b; Adler 2001). PME proceedings were chosen because it implies that both papers were written to similar criteria and for a similar audience. A drawback is that both papers are limited to 8 pages and therefore lack detail on the larger projects from which they are drawn. For background context I have therefore supplemented the papers with other relevant work by the authors. In examining these papers, I seek to uncover assumptions and practices which legitimate or reproduce linguistic discrimination in mathematics education research more generally.

Clarkson and Dawe, 1997

The research reported in Clarkson and Dawe's (1997) paper was conducted in two cities in Australia with high multilingual populations. A key theoretical background to their work is Cummins' threshold hypothesis (Cummins and Swain, 1986; Cummins, 2000) that relates linguistic proficiency of bilingual students to academic achievement. The paper looks at three questions: (1) do students use their first language (L1) when attempting mathematical problems? (2) is there a relationship between language competence and mathematical performance? (3) why do students swap languages during their work? The paper reports analysis of data collected from 252 students from 18 schools, from 24 different language backgrounds. The sample focused on 93 students of Vietnamese language backgrounds and 48 of English speaking backgrounds. The data consisted of scores from the following tests: an English language competency test, a Vietnamese language test, a mathematics test of symbolic items with no words in an alternate answer format, a mathematics test of short extended answer word problems, and a mathematical test of open ended items (more than one correct answer).

The question of language use appears to have been investigated through observation (this is not made clear in the paper). The authors report that "an important percentage…did [use L1] for each of the mathematics tests" (p. 155). To investigate a possible relationship between language competence and mathematical performance, the authors used language test scores to partition their samples. First the 'English speakers' English language scores were partitioned into thirds. The cut-off scores were then applied to the 'Vietnamese students'. The Vietnamese students were also partitioned into two groups based on their Vietnamese language scores, divided by the median. This process allows Vietnamese speaking students to be classified as having "relatively high competence in both their languages,…relatively low competence in both their languages, and students who had high competence in one of their languages…" (p. 156). Analyses of variance were then computed to investigate the effect of language competence on the mathematics test scores. The results showed significantly lower scores for the 'low competence in two languages' group, as well as higher (but not significantly) performance by the 'high competence in two languages' group, which they argue is in line with Cummins' hypothesis (Cummins and Swain, 1986). Finally, to investigate why students swap

language, a sample of students was interviewed “on how they completed three or four mathematical problems, in particular what language did they use in the process, and why” (p. 159). Although the interview data is not presented, the authors suggest some factors based on early analysis, including level of difficulty of the problem, affective response, and memory.

In many ways the paper challenges linguistic discrimination, demonstrated in the first instance by its focus on multilingual students, as well as by the finding that bilingual students with high competence in two languages outperformed monolingual students. In addition, the authors argue as a result of their work (following Cummins and Swain, 1986) that students’ first language plays a role in their learning of mathematics and it is therefore important that bilingual students maintain and develop competence in their first language. They conclude by contending that both teachers and curriculum writers need to be more aware of the role of first language in mathematics teaching and learning (p. 160), so placing the onus on the education system to respond to the needs of bilingual students rather than the other way round. There are however, a number of assumptions and practices which are evident in the way the research was conceived and conducted which may lead to linguistic discrimination.

English as the norm

In several ways Clarkson and Dawe’s (1997) paper positions English as the default language. The multilingual students who participated in the study are referred to as ‘Non English Speaking Background’ or NESB. Students’ language background is identified through the country of origin of the students’ parents, of which 34 countries “were predominantly at least non English speaking” (p. 154). English is also used as the norm for partitioning the multilingual students on the basis of English language competence. It is the scores of the ‘English speakers’ that are then used to label the multilingual students as high, medium or low competence. The English language test is referred to as an ‘English language competency test’, whilst the Vietnamese equivalent is referred to simply as a ‘Vietnamese language test’, implying English is a language in which students have competence, whilst Vietnamese is a language students either have or do not have.

Assumption of homogeneity

Multilingual populations, especially from migrant communities, are likely to be highly heterogeneous reflecting students’ diverse experience in two or more languages. In Clarkson and Dawe’s (1997) paper, it is not clear, for example, how long the Vietnamese students have been learning English or living in Australia. It is possible that the students categorised as highly competent in two languages have lived in Australia since birth and come from households including a native English speaker as well as a native Vietnamese speaker. Such households might be more affluent and provide more support for the students, both financial and motivational. Students categorised as having low competence in two languages might be recent arrivals in Australia and may come from poor

households including no native speakers of English and possibly native speakers of languages in addition to Vietnamese. My purpose in suggesting these scenarios is two-fold. Firstly, they highlight an assumption of homogeneity which arises in part as a result of taking a quantitative approach. This assumption leads to all students from Vietnamese backgrounds being seen as generally the same, distinguishable by their measured linguistic competence. Secondly, they point to the importance of diverse social and political factors in students' school attainment (see Secada, 1992). Such issues are not addressed in Clarkson and Dawe's (1997) paper (possibly due to its presentation at PME, a conference with a psychological focus). The same arguments also apply to the 'English speakers'. What is the difference, for example, between a student who speaks predominantly English but also a little Vietnamese, and a student who speaks predominantly English, but also a little French?

Written tests

There are a number of issues relating to the use of written tests as the main instruments in the study, a widely used practice in mathematics education research. No account is given of the effect of the language of the mathematics instruments. The processing of language in mathematics test items has been linked with attainment of multilingual students (e.g. Prins and Ulijn, 1998). Clarkson and Dawe (1997) also used a test "with no words" (p. 154), though the absence of words does not imply the absence of language, since the students have studied mathematics predominantly in English. Furthermore, written tests of linguistic competence only test an extremely limited form of competence, that of language tests. Such tests are likely to test forms of language use more familiar to students from monolingual backgrounds, and indeed from particular socio-economic backgrounds (Heath, 1983). Competence of multilingual students is likely to be different (Cummins, 2000). There are also likely to be differences in students' general orientation towards testing. Students from cultural and linguistic minorities may, for example, take longer to see tests as situations where they must display linguistic or mathematical competence and that these displays are important in the school context (Secada, 1991).

Adler, 1995

The research report by Adler (1995) contrasts in many respects with that of Clarkson and Dawe (1997). The research is qualitative in nature and comes from a wider project that "seeks a critical understanding of the complexities of teaching mathematics in multilingual classrooms through teachers' knowledge of their practice" (p. 208). The paper consists of the narration and discussion of an incident in the classroom of a teacher in the project, named Sue, who seeks to use a participatory-inquiry approach in her teaching. The majority of the students in the class are not native English speakers, unlike Sue who is "white and English speaking" (p. 211). Adler (1995) sets out the incident along with the teacher's comments from subsequent interviews. During a class feedback session, Joe, for whom English is an additional language, is asked to explain his

work. Sue perceives that he is struggling with the (English) language of the explanation and intervenes, 'deflecting' the issue by commenting on how Joe has labelled a diagram. Adler (1995) goes on to develop the description further, moving on to a more general discussion of some of the theoretical issues involved, highlighting a tension for Sue between engaging with 'communicative difficulties' and with mathematics.

As with Clarkson and Dawe (1997), there are elements of Adler's (1995) paper which are both challenge and reproduce linguistic discrimination. Discrimination is challenged through addressing issues of multilingualism in the teaching and learning of mathematics. Furthermore Adler's participatory, reflective approach allows the teacher to develop her practice through participation in the research, including how she deals with multilingual issues. Potentially, therefore, the approach will lead to more effective learning situations and opportunities for Sue's students. A participatory approach also allows issues relating to the multilingual nature of the class to emerge for teacher and researcher, rather than making preconceived assumptions about the 'problems' multilingualism might cause. By developing tensions as they are for Sue, Adler avoids making generalisations about the 'trouble' with multilingual classes or multilingual students. Some aspects of Adler's (1995) approach, however, do depend on discriminatory assumptions and practices.

Assumption of homogeneity

It is noticeable that there is relatively little of the students' voices in the paper. Joe appears in transcript excerpts, but the dominant voices in the paper are those of Adler and of Sue, the teacher. Admittedly the research focuses on teacher development in a multilingual context. This focus can perhaps lead to the relegation of the students to the status of background. The paper portrays the class in fairly general, homogenous terms. We are told that "the vast majority of pupils are black and not native English-speakers" (p. 211). Although Adler refers to the diversity of the class we can get no sense of this diversity. More detail is given in longer papers (e.g. Adler, 1999), including some of the languages used, as well as some information of the types of schools involved, but the class are still portrayed in fairly general terms. There is a sense that language is an issue for the teacher to deal with, but not for the students.

English as the norm

The diversity in the classroom becomes relevant in the light of Adler's (1995) summary of the emerging issues of communicative competence in the class, which include: "1. Pupils sometimes struggle to formally explain their thinking" and "2. Pupils are often unable to communicate and engage each other effectively…" (p. 212). My questions here concern the nature of communicative competence, explanation, thinking, and engagement. Arguably all these practices are part of culture and influenced by the different linguistic practices that form that culture. Different languages have associated with them different modes of explaining, of communicating or engaging. Students' diverse linguistic

and cultural backgrounds also imply different meanings for the words that are used by all participants. Adler's observations implicitly suggest that the nature of such linguistic practices and meanings is universal, or even that that the linguistic practices and meanings of English are the norm. Can Adler say, for example, that "pupils are…unable to communicate… effectively" (p. 212)? Or is it rather that they do not appear to communicate effectively according to the standards Adler is familiar with? According to this argument it is possible that English, or the linguistic practices and meanings of English, is being privileged in Adler's analysis of the classroom incident.

Linguistic discrimination in mathematics education research

Consideration of the two papers has highlighted a number of issues for mathematics education research. Neither paper could be labelled as wholly promoting or challenging linguistic discrimination. Indeed that was not the purpose of my analysis. Rather, through examining an example of the published work of two experienced researchers, I sought to raise issues of wider concern to researchers in mathematics education. These issues included the privileging of English as the default language in multilingual classrooms, the problematic use of written, quantitative instruments in assessing students from widely different cultural, linguistic and social backgrounds, the assumptions that students from particular language backgrounds are a homogenous group and the issue of differences in linguistic practices and meanings that arise from researching in multilingual, multicultural classrooms.

These issues could serve to legitimate or reproduce similar attitudes and consequences. In Adler's (1995) study, for example, the analysis was developed in part with the teacher. The privileging of English linguistic practices or meanings may therefore perpetuate a prevailing attitude in Sue's classroom, with the potential for teaching and research to devalue other languages and linguistic practices. Similarly, although Clarkson and Dawe (1997) argue from their results that students need support in their first language in studying mathematics and that this is the responsibility of the education system, their characterisation of students as having low competence in two languages could have potentially negative consequences for students of Vietnamese background. Their study *could* be interpreted as showing that linguistic minority students should be taught in English with no support for other languages.

My purpose in examining these two studies has *not* been to criticise the personal views, attitudes or indeed the competence of the researchers. Rather, it has been to critically explore the hidden assumptions and practices that may be present in much, if not all research in mathematics education, and which make up the ideologies and structures that lead to linguistic discrimination. The issues highlighted are likely to be issues in many research contexts, not only in research involving multilingual students. All students come from diverse backgrounds, have difference experience of language, of mathematics and of education and therefore have very different interpretations of what happens in

their mathematics classrooms. What, then, can mathematics education do to address the issues raised in this paper. To prompt further discussion, I conclude with some suggestions.

Suggestions for a way forward

Within mathematics education research, we could seek to address the role of different languages in our community. As individuals (particularly, as monolingual or monoliterate individuals) we could endeavour to learn to read other languages and read research published in less favoured languages. As a community, we could seek ways to make our conferences more multilingual by allowing more bilingual submissions and presentations. We could also seek ways to encourage literatures in less favoured languages, perhaps through subsidy, through translation or through our submissions and through what we cite. A further suggestion is that we find ways to support and develop research in the South, which includes many of the world's most multilingual classrooms, but also many of the world's poorest countries.

In terms of the practice of our research, a first step would be an increase in research that directly considers questions about the teaching and learning of mathematics in multilingual environments. We need approaches to research which take into account the diversity of cultural and linguistic background of our students and teachers, approaches which address or avoid assumptions of homogeneity and of common meaning. Indeed much general research in mathematics education would be strengthened by addressing these issues. Additionally, we could aim to move towards a greater critical awareness of the multilingual nature of society along with the related issues of power and dominance. In particular we could seek to avoid privileging a small number of languages and the ways of seeing and thinking that go with those languages. By embracing multilingualism, we can enrich both society and our research.

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