Institutional and pedagogical support for mathematics teachers working with NESB students

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Abstract

This paper presents the results of a survey investigating the provisions different secondary schools make for teaching mathematics to Non-English Speaking Background (NESB) students. The particular focus was on the ways ESL and Mathematics staff in secondary schools cater for NESB students' needs. The survey was carried out among Metropolitan Melbourne government schools, and among Catholic schools in the Archdiocese of Melbourne. The results reveal not only a wide range of school practices and provisions, but also some important teacher needs which are not being met.

It has long been recognised that the task of teaching secondary-level mathematics in classes containing large numbers of non-English speaking background (NESB) students with different first languages is a difficult one for any mathematics teacher. Research is making an impact by clarifying the kinds of difficulties mathematics learners face when learning through a second language, by exposing the cultural nature of the mathematics being taught and by commenting on the kinds of teaching practices which seem either to ameliorate or exacerbate the learners' problems. (see for example, Bishop, 1988, Cocking and Mestre, 1991, Clarkson, 1991, Sayers, 1992 and Secada 1992).

However at MERGA 1993, apart from Bishop's plenary address, there was only one paper addressing the issue, by Galligan (1993) - and this at a conference which had the specific theme 'Contexts in Mathematics Education'. What does the pause reflect? Possibly that the previous research had tended to focus strongly on the learners' situation, less strongly on the mathematical issues and almost not-at-all on the teachers' situation. One consequence of this imbalance has been that 'implications from the research' have been limited to 'advice for teachers'. That in itself is no bad thing, of course, and the book by MacGregor & Moore (1991) is without doubt the best example of this kind of advice, not only in Australia, but probably anywhere.

However teachers are not autonomous professionals and as is known, but all-too-seldom reflected in research, many other people affect what they are able to do and also what their

students are able to do in class. The social dimension (Bishop, 1993) of mathematics education is one with which researchers are only gradually coming to grips. In particular, and in relation to the study reported here, research has told us little about the roles, and influences on mathematics learning, of those in the schools who are not mathematics teachers. In this initial study we investigated the roles of three groups of teachers who influence NESB mathematics students' learning in secondary schools - mathematics teachers, science teachers, and ESL teachers.

Method

The research involved a questionnaire survey and a detailed interview (only the important results of the survey are reported here). The questionnaire was sent in October 1993, to all metropolitan Melbourne secondary schools with an NESB student population of 25% or greater according to the Directorate of School Education's (DSE) 1992 NESB survey. For their annual survey the DSE defines an NESB student as one who either: (1) was born in a non-English speaking country themselves, or (2) has at least one parent born in a non-English speaking country. The questionnaire was also sent to all secondary schools in the Archdiocese of Melbourne with an NESB student population of 25% or greater according to the Catholic Education Office's (CEO) definition which is similar to the DSE's.

The criteria resulted in a list of 115 DSE schools and 51 CEO schools. An additional criterion was that the schools should have at least one ESL staff member, and from the 66 responses from DSE schools, 57 met this criteria and from the 27 CEO responses, 22 met it. The analysis reported here is therefore from those final numbers of schools.

Results and discussion

It is important in a study like this not to overgeneralise, particularly in view of the wide variation in provision and practices. Just in regard to ESL staffing, schools had from 0.1 to 25 EFT (Effective Full Time) teachers (remembering that those with zero ESL staffing were removed before results were tabulated.) Tables of results should therefore be read bearing in mind not only that each school is unique but that all surveys have limitations.

Part A: ESL involvement in mathematics and science

Tables 1 and 2 summarise the information provided by the ESL Co-ordinator regarding ESL involvement in mathematics and science. A number of observations can be made and are presented in no particular order of importance:

* ESL staff in DSE schools are very likely to be involved in some way in mathematics and science teaching. Only 9 of the 57 respondents from DSE schools were not able to state some way in which ESL is involved with either of the subjects. In CEO schools, a larger proportion (8 out of 22 maths, and 6 out of 22 science respondents) were not able to state some way in which ESL is involved with either of the subjects.
* ESL staff are slightly more likely to be involved in science than in mathematics teaching.
* The most common way that ESL staff work with students is either in a team teaching mode (Table 1 (b) & (c) or in a support capacity (Table 2 (f1).
* Although some schools are unlikely to have adopted any of the 5 categories of approaches to ESL mentioned in question 3 they are however likely to have adopted one or more other practices - see Table 2. In DSE schools 30 out of the 36 respondents for mathematics and 25 out of 36 for science who described "other" arrangements had <u>not</u> responded positively to <u>any</u> of the options 3 (a) to (e) listed.

	DSE Schools		CEO Schools	
	Maths	Science	Maths	Science
	yes %	yes %	yes %	yes %
(a) Joint planning: the mainstream and the ESL teachers frequently jointly prepare materials for use in regular classes.	5.2	19	9	27
(b) Team teaching: the mainstream and ESL teachers together teach the one class of "NESB only" students some or all of the time	4	7	5	9
(c) Team teaching: the mainstream and ESL teacher together teach the one class of mixed NESB and English speaking background students some or all of the time	12	19	9	27
(d) Integrated withdrawal: the ESL specialist takes a group out of the mainstream class and integrates the ESL learning with the subject content.	4	12	27	27
(e) Parallel teaching: the ESL specialist teaches the mainstream program, or a modified program, to a group separated out of mainstream classes.	0	4	14	18

Table 1 .

Table 2 shows the more frequently offered 'other methods'. Less frequently mentioned were:

ESL support in other classes, withdrawal of new arrivals from class, joint planning at the end of year, helping subject teacher with wording tests and assignments, informal consultation on courses, displays of resources, and providing interpreters at information sessions and parents' evenings.

	DSE Schools		CEO Schools	
	Maths/36	Science/36	Maths/8	Science/11
f1 Support (ESL & MEA) in maths/science class	25	23	2	2
f2 Support in timetabled ESL class	7	8	1	1
f4 Support (ESL & MEA) at arranged times	6	6	3	4
f6 Withdrawal group (various subjects)	5	7	0	0
f14 ESL awareness via faculty meetings/professional development	5	4	0	2

Table 2

The overall picture then is one where most schools have some level of ESL involvement in mathematics and science education. What the survey and results do not do however is disclose the **extent** to which the practices occur. It has been made clear on some surveys, through answers given in table 2 and through follow up phone conversations that ESL contact may be quite restricted or frequently occur on an ad hoc basis.

Part B: Mathematics and Science teachers and the NESB student

The results of questions 4 and 5 (Table 3) only give a base-line indication of whether there is some staff expertise in a school in relation to NESB students and subject specific learning as the questionnaire did not ask for numbers of staff. Question 7 revealed an important difference between DSE and CEO schools, and the systematic assessment of student language difficulties and needs (Qu 9) is as rare as is the provision of bilingual lesson notes (Qu 8). Questions on the selection of student texts indicate that staff are generally sensitive about their level of language difficulty but show less concern about cultural diversity being reflected in content and format. No doubt the comment made on one questionnaire that "choices available do not offer such diversity" provides one explanation for almost 50% of co-ordinators saying that they do not consider ethnicity in relation to choosing student texts. It is also likely that the importance of this issue, like that of gender before it, has not really been widely appreciated to date.

	DSE Schools		CEO Schools	
	Maths	Science	Maths	Science
	yes %	yes %	yes %	yes %
Q4 Has any mainstream teacher currently teaching in maths/science had training in ESL teaching (as a method)?	18	11	14	18
Q5 Is any maths/science teacher currently using teaching strategies as a result of an inservice program on meeting the needs of NESB students?	25	44	64	68
Q7 Do ethnic aides and/or volunteer parents form part of any program to teach maths/science to NESB students?	42	40	9	14
Q8 Does the maths/science faculty provide bilingual lesson notes to students?	2	12	5	0
Q9 Does the maths/science faculty undertake any systematic assessment of students language difficulties and needs?	8	5	18	14
Q10 With the maths/science faculty is it policy or routine practice to select students texts carefully for: (a) the level of language difficulty?	90	91	81	95
(b) The cultural diversity reflected in the content and/or format.	58	54	36	55

Table 3

Several open ended questions were directed to the Mathematics and Science Co-Ordinators who more often than not answered with a simple yes or no response. While trends for each question can be seen in these yes/no answers a great deal more is revealed in many written responses which cannot be included here because of their length. What follows is a summary of the main categories of recorded data and a discussion of the findings for each part of question 11, for the DSE respondents only.

11(a) Are staff aware of ESL issues and needs of students and are they able to employ appropriate language learning strategies in teaching their particular subject?

Mathematics Co-ordinators answered Yes 28, No 3, and in their written responses they mentioned using writing in the subject area, modifying explanations to include all students, explaining concepts in as many simple ways as possible, minimising the inappropriate language content and spending more time with students experiencing difficulties. Science Co-ordinators answered Yes 22, No 8, and stated many of the same things but in addition they spoke of the use of visual aids, practical exercises to illustrate concepts, elaborating on word meanings, and introducing work requirements to meet the needs of students.

A significant number of written responses however indicated that while staff are aware of student needs they are either not able, or are only partially able, to employ language learning strategies. Several replies indicated that maths/science faculties have also not addressed this issue in terms of policies and structured approaches to teaching and learning that can be used as group or whole class strategies. Finally a few replies said that the issue had not been seen as important, or it lacked priority, or that it was fortunate that (apart from worded problems) a lot of maths involves little language.

11(b) Are staff familiar with the different conventions that may be used to write maths statements e.g. $40,99 instead of $40.99?

11(c) Are staff familiar with different ways of setting out and working out maths algorithms?

Mathematics coordinators answered Yes 33, No 7 to 11(b) and Yes 36, No 3 to 11(c) and further indicated that the majority of maths teachers appeared to be aware or partially aware of the different conventions that can be used to write mathematical statements and the different ways of setting out maths algorithms. Science teachers seemed to be slightly less aware. Science coordinators answered Yes 24, No 11, to 11 (b) and Yes 22, No 8 to 11 (c). Many of them, (8 for 11(b) and 17 for 11(c)), questioned the relevance of these questions to their subject area by either not responding to the questions or by writing, for example: not applicable, ??, irrelevant in science, N/A, isn't this inappropriate? and science is a universal language.

11(d) Have the staff adequate resource material to cater for the needs of NESB students?

Maths coordinators answered Yes 11, No 30 to this question while Science coordinators answered Yes 6, No 27. In their written responses both Mathematics and Science Co-ordinators stated that resources are "limited", "reasonable" or "fair" with others claiming to have "some" or "adequate" resources saying they could use more. A few identified areas of need such as ways of giving NESB students practice with "real life" worded maths problems, maths notes and textbooks in languages other than English, and practical activities in science. One reply said, "it is a very minor problem and as a result there are little or no resources".

11(e) Do staff feel adequately supported in catering for the needs of NESB students?

The Yes 11, No 27 for Maths and Yes 9, No 27 for Science indicated that both Mathematics

and Science Co-ordinators felt there is a need, whilst at the same time paying tribute to the help and advice of existing ESL staff. The Maths replies also revealed that some staff see the problem only in terms of catering for the needs of the individual student.

11(f) Would staff benefit from further professional development in regard to teaching NESB students?

More than 90% of Mathematics and Science Co-ordinators said their staff would definitely benefit from further professional development in regard to teaching NESB students. Some written statements qualified the 'yes' with concerns about professional development directly relating to the subject area, teacher workload and the time to implement and review strategies in school time, while others said it was not a high priority.

CONCLUSIONS

What can be learned from the survey? The ESL response indicates that ESL involvement is most likely to be of a support nature with staff going into the maths or science classrooms rather than a partnership arrangement of shared responsibility ie. joint planning and team teaching. ESL classroom support is designed to assist the individual student but by its very nature, and by the qualifications of the majority of personnel involved, it is likely to have little or no effect on the way the subject teacher teaches the class or assesses student progress. The subject teacher's ability to cater for a wide range of NESB students is much more likely to be a result of pre-service or inservice training aimed at providing teachers with language learning strategies which can be incorporated into their teaching methodology and be applied at the planning stage of course design and delivery.

A few of the schools have mathematics and science staff with ESL training and even more have staff who have been inserviced to meet the needs of NESB students but they are still in a minority. Other staff could have gained this professional knowledge in other ways e.g. "through experience of teaching these students in main"[sic], "regular professional development sessions". Nevertheless a large minority of mathematics and science co-ordinators indicated their staff are not aware of the issues, needs and teaching strategies appropriate for NESB students in their classes. More importantly there are indications that the issues have not been addressed by whole faculties but only by particular staff, if at all.

The main conclusion which can be drawn is that the most common ways in which ESL staff are involved in mathematics and science education, and the development of special programs such as the Pre VCE Course mentioned by a few coordinators, will not affect the education of the vast majority of NESB students. Essentially some relatively recent arrivals from non-English speaking countries will benefit in some classes in some schools. This means that most NESB students must rely solely on the expertise of the subject teacher. For this reason a concentration of effort on the professional development of mathematics and science staff and the development of support materials seems to be essential to increase the access and success of NESB student in mathematics.

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