NESB MIGRANT STUDENTS STUDYING MATHEMATICS: VIETNAMESE STUDENTS IN MELBOURNE AND SYDNEY1

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This paper describes one part of a project which is working with migrant bilingual Arabic, Italian and Vietnamese children who are learning mathematics in Australia. We are particularly interested in students who choose to switch between their languages when processing mathematical problems. What may prompt a bilingual student to switch languages? How often does it occur? Does it depend on the mathematical context? What changes might occur as the student progresses through primary school?
In this paper data collected in both Sydney and Melbourne from grade 4 students will be discussed. Data were obtained both from standard group test procedures, as well as individual interviews with a sample of the students. Particular emphasis is given to the Vietnamese students' responses. Comparisons between the two cities which have some different approaches and conditions in their schools will be noted. Comment on Cummins threshold hypothesis will be made, as will some reflections on the implications for teachers and curriculum developers.

Australia is a land of many languages. Although the official and by far the most dominant language is Australian English, many other languages are used everyday as citizens go about their daily lives. One way this has been recognized is through the continuing policy of `multiculturalism'. This policy is not just a recognition that Australia has drawn citizens from many lands, some of which do not have English as their first language, but is a policy that actively recognizes the multicultural background of its citizen as they live together in one nation.

In most urban schools in Australia's major cities there are many languages represented. It is common for a class grouping of 25 to 30 children to come from families representing five or six countries. In some parts of Sydney and Melbourne this can rise to ten or more. What then is the teacher to do who is probably a monolingual English speaker? For the most part English is used as the language of the classroom, although other languages represented in the classroom are recognized in some way. Such a response is normally justified on social grounds such as it gives access and status to each student's particular cultural background which is held to be important. The authors are totally in favor of this response. However they suggest that other cognitive grounds are just as important and are often not recognized by teachers.

The interplay between language and mathematics learning is now recognized as being a critical factor for the mathematics classroom (see Ellerton & Clarkson, 1996 for a comprehensive review). Earlier research by the authors has contributed to this debate in the area of bilingualism; Clarkson with primary students in Papua New Guinea and Dawe with secondary students in England (see for example Clarkson, 1992; Dawe, 1983). This earlier independent work drew on the theoretical position of Cummins (Cummins & Swain, 1986). Cummins hypothesized that the level of competence that a bilingual child achieved in both her/his languages was critical to academic performance.

In working with teachers in Australian schools there was not always a recognition of this cognitive feature of bilingualism. Often a naive position was taken that the first language (L1) was some what irrelevant, although competence in the language of learning, in this context English (L2), may be important. Many non bilingual teachers, the majority in our systems, were not really aware that their bilingual students would indeed swap languages while thinking about their classwork. If this was conceded by some teachers, then such a possibility may happen for cultural or language based work, but not for mathematics. Of course when you are teaching children from such a diverse background of languages, in the pressures of `keeping the classroom going', it is not always easy to see such common threads. This is a very different teaching situation for an English speaking teacher who might have a classroom of bilingual children, but virtually all of them are from say a Spanish speaking background, which may happen in the southern states of the USA

The Present Project

The authors have reported on this project elsewhere and the details will not be repeated here (Clarkson, 1996; Clarkson & Dawe, 1994). This paper reports on preliminary analysis of a data base of some 850 year 4 (age 9-10 years) students studying mathematics in Melbourne or Sydney. Eighteen schools were involved with parents coming from 42 identified countrie plus otherss, 34 of which were predominately at least non English speaking. For this paper, 252 cases were drawn from this data base representing those classes which had a high proportion of Vietnamese students. But still 24 identified countries were represented with 18 different non English speaking backgrounds.

In this paper the following group tests will be referred to:
an English language competency test with a maximum score of 20,
a Vietnamese language test with a maximum score of 8,
a mathematics test composed of symbolic items with no words in an alternate answer format, the raw score of which can be converted to Byte Scores, a measure of cognitive level,
a mathematics test which was composed of short extended answer word problems (Mathematical Word Problems Test) with a maximum score of 10,
a mathematical test which was composed of open ended items in that there was more than one correct answer (Mathematical Novel Problems Test). This test gave rise to a raw score (the number of items for which one answer was correct giving a maximum score of 10) and a `novel' score (one point for each correct answer, with up to three answers scored per item, giving a maximum score of 30).

Using L1 for Mathematics?

The first notion we were interested in exploring was whether the children did use their two language when attempting mathematical problems. Tables 1 and 2 show that indeed an important percentage of this sample of students did so for each of the mathematics tests. There seemed to be a consistent higher proportion of Sydney students who used their L1 in the solution process. Based on observations of the schools in which the authors were working,

there did seemed to be a higher support for the maintenance of the students' L1 in Sydney schools with the employment of full-time bilingual teachers for this specific task. In turn this seemed to be a function of the larger size of the Sydney schools and hence their ability to direct a larger amount of money to this task, even though the proportion of funds in both Melbourne and Sydney individual schools may be similar. However it seems clear that the first message for teachers and curriculum developers is that a high proportion of students will be using their L1 for at least some of their mathematical thinking.

TABLE 1: Number of items for which the following percentage of students chose to use their L1 for at least part of the solution process on the Symbols Test (Sydney N=57; Melbourne N=85)

TABLE 2: Number of items for which the following percentage of students chose to use their L1 for at least part of the solution process on the Word Problems Test and on the Novel Problems Test (Sydney N=57;

Melbourne N=85)

It is one thing to know that students are using their L1 in the solution process. However whether it makes a difference to the academic performance of students is another question. Table 3 suggests that the use of L1 does have some effect, but it is not consistent across mathematical context, and different schooling experiences may also play some role.

TABLE 3: Correlations between scores on the three tests and the number of items for which students chose to use their L1 for at least part of the solution process (Sydney N=57; Melbourne N=85)

The Effects of Bilingualism

Table 4 shows the means and standard deviations for the two language tests and two mathematics tests. It is seen that there appears to be little difference between the performance of the groups.

TABLE 4: The means and standard deviations of four group instruments for the total sample of students, the Vietnamese speaking, and the English speaking students.

To have some measure of the bilingual students' language competencies, a process similar to that employed by the authors and others in earlier studies was used. The frequency of scores on the English Language Test for the sample of English speakers was analyzed. Cut off scores which divided the group into thirds were determined. These cut off scores were then used to partition the sample of Vietnamese students into three groups. The frequency of scores on the Vietnamese Language Test for the Vietnamese students was analyzed. The group was partitioned into two groups using the median score. Hence the Vietnamese students

were partitioned into six cells. In this way it was able to identify Vietnamese students who had relatively high competence in both their languages, students who had relatively low competence in both their languages, and students who had high competence in one of their languages termed `one dominant' students. There were also some students in this sampling process who were dropped out of the sample as they were deemed to have a medium competency in English. Hence a new variable `Bilingual Language' with three categories was defined.

Three analyses of variance were computed to investigate the effect of the level of bilingual competence on the raw scores of the Mathematical Word Problems Test and the Mathematical Novel Problem Test, and on the `novel' score on the latter test. In each analysis the Byte Score, which is a measure of their cognitive level, for each student was incorporated.

Each analysis showed that the students included as having high competence in both their languages outperformed the other two groups, although Scheffe tests indicated that in each case the differences between this group and the `one dominant' group were not statistically different. Both these groups however were significantly different to the students who were categorized as having low competency in both their languages. Although this is a small sample and more detailed analysis is still to be completed, it is interesting to note that these results are in line with Cummins' threshold hypotheses, and are similar to previous results that the authors have found working with very different groups of students in other countries.

Why do Students Swap?

The analyses show so far that the bilingual students do swap between their languages when doing mathematics, a fact not always recognized by teachers and curriculum developers. Further there is some suggestion that this is influenced by mathematical context and schooling. Not only this, the competencies that students have in both their languages may well be another important factor in their learning of mathematics.

However there is still the intriguing question of why do students swap languages, in learning environments that do not actively encouraged students to do so, nor recognize that this strategy is used. A sample of students from each school was interviewed on how they completed three or four mathematical problems, in particular what language did they used in the process, and why. Some speculation on this has been entered into elsewhere (Clarkson & Dawe, 1994) and some preliminary comments have also been recorded (Clarkson, 1996). Further analysis of the interview data is progressing and future papers will focus specifically on these matters. It seems to us that some interlocking factors are present here, with probably more than one having an influence in any one situation. Difficulty is certainly one dimension. If the student feels the item is difficult because of meanings not being clear when reading or comprehending the problem, then a switch may occur. However an affective response may also be playing some part in that students simply like to use this or that language. Memory also plays a role in that some students may recognize a problem, or an aspect of a problem, which is similar in some way to a previous one for which they obtained help from a significant other. If that help was given in their L1, then this may prompt a switch as the student enters fully into that memory situation.

We can not stress enough the complexity of the process in which the students are involved. Any solution process is involved, if it is more than rote application of a well known routine for the student. With

bilinguals there are clearly added fields of complexity. We feel we are dealing with `messy' data all the time, not because we have inadequate methodological approaches, but because the very nature of the phenomena is complex and `messy'. However we also believe it is giving rich insights into how children learn mathematics.

Conclusion

In `The Age', Melbourne's leading broadsheet newspaper, a recent article on page three was headed `Schools are failing immigrants: study' (Milburn, 1996). The gist of the argument was that students from non English speaking backgrounds at school needed more help with learning English as a second language. We have no problem with this position, as far as it goes. The recent government cutbacks at both Federal and State level do not help. But we would contend that this is only part of the story. Such students also need help with maintaining competence in their L1. Just as teachers recognize the importance of different ways of thinking about mathematics, be they analytic, visual, etc., and attune their methods of teaching to support these thinking strategies, so they, and curriculum writers, also need to be far more aware of the role that L1 plays across the whole of the school curriculum including mathematics, and plan to use the advantages that this can bring.

TABLE 5: Analysis of variance using the score on the Mathematical Word Problems Test as the dependent variable, a Bilingual Language (LL) variable as an independent variable, with the Byte Score (MSBS), a measure of cognitive level as a covariant.

Source of Variation	Sum of Squares	DF	Mean Square	F	Sig of F
Covariates MSBS	42.813	1	42.813	18.735	.000
Main Effects LL	56.867	2	28.433	12.442	.000
Explained	99.679	3	33.226	14.540	.000
Residual	127.971	56	2.285		
Total	227.650	59	3.858		

M u l t i p l e   c l a s s i f i c a t i o n   a n a l y s i s

Grand Mean = 6.65

Variable + Category	N	Unadjusted Dev'n	Eta	Adjusted for Independents + Covariates Dev'n	Beta
LL					
1	10	-2.15		-1.90	
2	42	0.18		0.14	
3	8	1.72		1.62	
			0.56		0.51

Multiple R Squared 0.438
Multiple 0.662

TABLE 6: Analysis of variance using the raw score on the Mathematical Novels Problem Test as the dependent variable, a Bilingual Language (LL) variable as an independent variable, with the Byte Score (MSBS), a measure of cognitive level as a covariant.

Source of Variation	Sum of Squares	DF	Mean Square	F	Sig of F
Covariates MSBS	7.653	1	7.653	2.061	.157
Main Effects LL	47.239	2	23.620	6.361	.003
Explained	54.892	3	18.297	4.927	.004
Residual	211.665	57	3.713		
Total	266.557	60	4.443		

M u l t i p l e   c l a s s i f i c a t i o n   a n a l y s i s

Grand Mean = 4.61

Variable + Category	N	Unadjusted Dev'n	Eta	Adjusted for Independents + Covariates Dev'n	Beta
LL					
1	11	-1.79		-1.71	
2	42	0.20		0.19	
3	8	1.39		1.36	
			0.44		0.43

Multiple R Squared 0.206
Multiple R 0.454

Notes

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TABLE 7: Analysis of variance using the `novel' score on the Mathematical Novel Problem Test as the dependent variable, a Bilingual Language (LL) variable as an independent variable, with the Byte Score (MSBS), a measure of cognitive level as a covariant.

Source of Variation	Sum of Squares	DF	Mean Square	F	Sig of F
Covariates MSBS	65.195	1	65.195	3.119	.083
Main Effects LL	177.305	2	88.653	4.241	.019
Explained	242.500	3	80.833	3.867	.014
Residual	1191.435	57	20.902		
Total	1433.934	60	23.899		

M u l t i p l e   c l a s s i f i c a t i o n   a n a l y s i s

Grand Mean = 9.03

Variable + Category	N	Unadjusted Dev'n	Eta	Adjusted for Independents + Covariates Dev'n	Beta
LL					
1	11	-3.85		-3.58	
2	42	0.63		0.58	
3	8	1.97		1.85	
			0.38		0.36

Multiple R Squared	0.169
Multiple R	0.411

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