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MONASH UNIVERSITY  
THESIS ACCEPTED IN SATISFACTION OF THE  
REQUIREMENTS FOR THE DEGREE OF  
DOCTOR OF PHILOSOPHY  
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**Immigration and Mathematics Education over Five Decades:  
Responses of Australian Mathematics Educators  
to the Ethnically Diverse Classroom**

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A thesis submitted in fulfilment of the requirements

for the degree of

**Doctor of Philosophy**

in the

**Faculty of Education**

**Monash University**

2001

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## Abstract

By 1955 Australia had accepted its first million post war immigrants. This first wave of mainly Anglo-Celtic immigrants was succeeded by a wave of Europeans from non-English speaking countries. By the 1970s a third wave of mainly Asian, African and South American immigrants was arriving. In fifty years Australia's small and relatively homogenous population had become one of the most diverse populations in the world.

Assimilation characterized the main thrust of early immigration policy but, by the late 1970s, acknowledgement of the impact made on the Australian way of life by diverse immigration, resulted in a policy of multiculturalism, which recognized the place of different ethnic cultures in Australia's society. In education, multiculturalism meant the establishment of English language resources in schools and government funding directed towards appropriate curriculum resources.

Mathematics education in this interval had retained its important constituency in the curriculum of Australian schools. Despite difficulties created by postwar shortages of accommodation and teachers, a curriculum was evolving in which pedagogy was directed to each student as an individual learner. New mathematics curriculum had been devised and in the ensuing years the trend towards individualistic pedagogy, now placed largely in the domain of the classroom teacher, continued. This educational direction, on the surface appeared to relate well, to the spirit of multiculturalism. Support for culturally related mathematics education came also in the 1980s and 1990s, from research findings in mathematics teaching and learning which negated the view of mathematics education as a remote and purist discipline, and identified cultural connection as a key factor in its teaching and learning. How then did mathematics educators respond to the diverse cultural backgrounds of ethnic minority students?

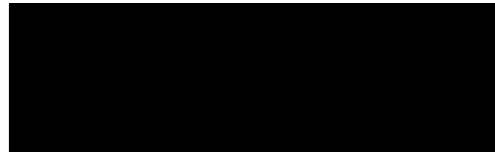
Two sets of mathematics educators governed events within the mathematics classroom. Government and sector authorities, called macro educators in this thesis, were responsible for intentional policy and its dissemination to schools and practising classroom teachers were responsible for the implementation of mathematics

education within the classroom. How complementary were any policy responses of the macro educators to the practical responses implemented by a group of Victorian mathematics teachers? It was found that while some responses in the policy and practice of the mathematics educators were complementary, others were contradictory. Responses made by one set of mathematics educators were not made by the other. In an example of this latter circumstance, teachers had recognized the role of culture in the mathematics education of their ethnic minority students, before the findings of research which related to culture and mathematics education had emerged, and had devised strategies to address what most of them perceived as disadvantage. The macro educators, for all the multicultural rhetoric they used in education papers and documents relating to policies of multiculturalism in education, applied these policies to various subjects but not to mathematics. They did however, unlike teachers, recognize, explore and value attributes of the experiences ethnic minority students brought with them to Australian mathematics classrooms. In the 1990s, macro educators became concerned with mathematical standards in Australian schools and imposed programs of compulsory curriculum and testing.

Globalization has accelerated population movement patterns and immigration around the world. New types of international mobility are assuming major significance, especially clandestine movement and asylum seeking. In 2001 Australia is treading a confused path through an onslaught of illegal immigration. Communication and shared endeavour between the mathematics educators, between research and practice in mathematics and between mathematics education and immigration policy would seem to be priorities in the future years.

### **Declaration**

This thesis contains no material which has been accepted for the award of any other degree or diploma in any university. To the best of my knowledge and belief, it contains no material previously published or written by another person, except where due reference is made in the text of the thesis.



Susan E. Wotley

## Acknowledgements

When I first undertook to write this thesis the vocabulary which came so easily from the lips of staff and postgraduate students presented, for me, a substantial challenge. As a practising mathematics teacher and school administrator for twenty years I had managed to build an entire career in complete ignorance of much of the terminology of education research. Obviously there was a new language to be learnt and it needed to be learnt quickly in order for my thesis to proceed.

But I have been fortunate in my supervisor. Alan Bishop has always patiently answered my questions and has reassured me in my uncertainty. He has shown a genuine interest in my work and has received my ideas with considered and helpful criticism. His broad knowledge of mathematics education has been a great help to me in establishing the directions of my research. Finally, his enthusiasm and friendship were wonderful incentives in my efforts to complete this thesis.

There are others who I should acknowledge also. I owe special thanks to Dr Gail FitzSimons with whom I shared a small office, and who was extremely supportive in terms of technological assistance and resources, not to mention her friendship and the happy times we spent together. The staff and post-graduate students of the mathematics department also deserve my thanks firstly for their generosity and good humour and secondly for their capacity as good listeners who contributed valuable commentary. My special thanks go to Wee Tiong Seah, Elizabeth Buckingham, Sharon Gunn and Jude Ocean.

Finally I should acknowledge the help and encouragement given to me by my family who have shown great consideration for my well-being and have supported me in my endeavours. My particular thanks go to my husband who relieved me of many necessary tasks to allow me the space and time to complete my thesis.



## Abbreviations

AACRDE	Australian Advisory Committee on Research and Development in Education
AAMT	Australian Association of Mathematics Teachers
ABS	Australian Bureau of Statistics
ACER	Australian Council for Educational Research
ACT	Australian Capital Territory
ACU	Australian Catholic University
AEC	Australian Education Council
AISV	Association of Independent Schools of Victoria
BIMPR	Bureau of Immigration Multicultural Policy and Research
CDC	Curriculum Development Centre
CEO	Catholic Education Office
CMEP	Child Migrant Education Program
CSF	Curriculum and Standards Framework
CSIRO	Commonwealth Scientific and Industrial Research Organization
DEET	Department of Education, Employment and Training
ERDC	Education Research and Development Committee
ESL	English as a Second Language
HSC	Higher School Certificate
IARTV	Independent Association of Registered Teachers in Victoria
LAP	Learning Assessment Project
LOTE	Language other than English
LSAY	Longitudinal Surveys of Australian Youth
MACMME	Ministerial Advisory Committee of Multicultural and Migrant Education
MAV	Mathematical Association of Victoria
MERGA	Mathematics Education Research Group of Australasia
NACCME	National Advisory and Coordinating Committee on Multicultural Education
NCTM	National Council of Teachers of Mathematics (USA)
NESB	Non-English Speaking Background
RIME	Reality in Mathematics Education
TAFE	Technical and Further Education
TEFL	Teaching English as a Foreign Language
TESL	Teaching English as a Second Language
VCAB	Victorian Curriculum and Assessment Board
VCE	Victorian Certificate of Education
VISE	Victorian Institute of Secondary Education
VSTA	Victorian Secondary Teachers Association
VUSEB	Victorian Universities Schools and Examination Board

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## Chapter 1

### *Foundations of investigation*

One day, in the early 1950s, in the fourth year of my education at a small country high school of less than two hundred students, our headmaster asked us to welcome a group of new students explaining that they had been brought by bus from a nearby aerodrome, previously used by the R.A.A.F during World War 2. It was now a holding camp for migrant families mainly from Baltic and Eastern European countries such as Latvia, Lithuania, Estonia, Poland, Ukraine, Czechoslovakia, Roumania and Yugoslavia. Some of these countries were known to me only because of my passion for stamp collecting. Their names had not occurred in the array of subjects of my school year which included English Literature, British History, French and Geography (largely Australian) and Art History which concerned the classical works of Western Europe (English, French, Spanish, Greek and Italian), while in Mathematics and Science, elements of the archaic languages, Ancient Greek and Latin, were indirect connections with European political geography.

The complicated and beautifully written script of the Latvians who arrived in my mathematics class was a revelation. As the highest achieving mathematics student in my year I was impressed by the elegance and logical setting out of answers, unblemished by error. "Crossing out", was a process acceptable to our Australian mathematics teachers. The level of motivation and energy of this migrant group was high. They did not waste class time, did more than the required set work, and asked questions, mostly related to English, of the teacher and students. They achieved high results in tests and exams. The reaction of my competitive nature to this onslaught was to work much harder and to cease wasting time when I finished set exercises earlier than the other students in mathematics. The "untidy paddocks" (my teacher's words) into which I had previously crammed my answers were replaced by neater work. Even my handwriting changed. I was motivated to read and learn about Latvia, in particular about the origins and structure of its language and the script in which it was written.

The galvanizing of my energy and the stimulation which came with it were direct outcomes of the arrival of migrant students in my classroom. For me the effects were most significant in mathematics where, it seemed, the attitudes of these students demolished a sort of limiting intellectual barrier connected to routine practice in classroom mathematics. One of the policies of practice in my mathematics classroom was aimed at the arrival of all students at the same place in our mathematics textbook at the same time – hence I had waited or helped others until they reached the same point. I now quietly experimented with further chapters although I did not consult the teacher. I spent more time practising writing and careful setting out of my work. To minimize errors, I thought the work through before committing myself to paper – in fact, my attitude, my processing and my knowledge all changed. What aspects of mathematical teaching and learning caused this change?

The curriculum presented to us in Year 10 mathematics at the school, the text book used, the teacher, the testing and examination pattern, the Australian-born cohort of students, the teaching environment all remained unaltered after the migrant students became members of the class. Furthermore there were few opportunities to make social contact with these students outside the classroom. Their lack of English, relative disinterest in curricular sports activities (in which they were compelled to participate) and our own obsessive activities in sport, confined them to national groups between classes. The fact that they were returned to the camp by bus immediately at the end of the school day prevented after school contact. The prime mover therefore of change for me, seemed to be a cultural stimulus within the mathematics classroom more related to “how” solutions were reached than to “what” mathematics was being studied. Despite the teacher-centred style of class management of these times it was possible for me to work with them and to exchange solutions, without the need for much conversation. In this solitary student episode I can remember the role of the teacher only as a source of personal encouragement and approval of my improved effort and performance. Thus the positive contributions that the migrant students had made to me, despite their limited knowledge of English, did not directly involve my mathematics teacher, but were the result of student exchange. I could only speculate about whether I had made any positive contribution to the mathematics of the Latvian students.

Later, in my career I became a secondary school mathematics teacher and a curriculum co-ordinator, working in three schools where migrant students attended, in various proportions. I became interested in the responses of mathematics educators to classes with high degrees of ethnic diversity which resulted from a now, huge postwar program of immigration to Australia. Having experienced an enhancement of my own mathematical progress as a result of interchange with migrant students, I questioned later, as a teacher, how beneficial qualities might have been recognized and harnessed by mathematics educators at different levels. In my experience as a mathematics student in the 1950s, I had noted and absorbed the high levels of self-discipline, motivation and achievement of the Latvian students who joined my classroom at year 10 level. Were these qualities typical of all immigrant students? Were they still present in the mathematics classrooms of 1990s when the numbers and ethnic origins of immigrant children in mathematics classrooms had increased dramatically?

#### **1.1 From the 1950s to the 1990s**

In 2000 the Longitudinal Surveys of Australian Youth (LSAY) project (ACER, 2000) included reports on patterns of enrolment in mathematics at year 12 level and related these patterns to ethnic background, using 1988 data on subject choice and 1995 data on achievement in numeracy.

Historically, mathematics education has occupied a prominent place in Australian education (Horwood, 1997). The LSAY Research Report Number 15 (Fullarton and Ainley, 2000) stated that almost 90% of students studied at least one mathematics subject in year 12. The report compared mathematics with other subjects as follows:

Since the subject choice report of 1994, enrolments in English and Mathematics have remained reasonably stable. In general, subject enrolments in Studies in Society and Environment have declined, with the exception of business studies. In the Sciences, there has been an increase in the proportion of students enrolled in general science subjects. Enrolments in the Arts and Languages other than English have remained reasonably stable, while in the Technology area, enrolments in computer studies, technical studies and food and catering have

increased substantially while those in home economics have declined. In Health and Physical Education enrolments have increased.

(Fullarton & Ainley, 2000, v)

Thus mathematics had retained a consistently high profile among subject choices in the 1990s. What patterns of ethnic participation were present in the choice of mathematics in the 1990s? It will be seen later in this thesis that, over the period of study, various institutions and mathematics educators have arrived at different definitions of ethnicity and this has created difficulties in comparative areas of statistical research and in use of a single terminology. In the LSAY report parental background was classified as Australian/English (students with both parents born in Australia or in overseas English speaking countries) or non-English (one or both parents from a non-English speaking country).

Firstly the percentages of non-English students taking year 12 mathematics was higher than that of Australian/English students. The report summarized the findings as follows:

Compared to students with parents born in Australia or another English-speaking country, students whose parents were born in a non-English speaking country were more likely to study mathematics....Again using the Victorian data as an example, 23 per cent of students whose parents were born in a non-English speaking country compared to 19 percent of students from an Australian or other English speaking country were studying Specialist Mathematics (Fullarton & Ainley, 2000, 19).

(Specialist Mathematics is the most difficult of the prescribed mathematics courses at year 12 level and is generally taken with another mathematics subject, Mathematics Methods – researcher's note).

In relation to Mathematics achievement, the report noted the following:

- Early achievement in mathematics was an indicator of continuation of mathematics at year 12 level.
- Students with higher achievement levels were more likely to study more than one mathematics at year 12 level
- Students with the highest achievement levels were more likely to study the more advanced forms of mathematics (such as Specialist Mathematics) at year 12 level

- 61 percent of students studying Specialist Mathematics were in the top quartile of mathematics achievement at year 9 level (Fullarton & Ainley, 2000).

The effect of combining these findings would seem to present a picture of high non-English or NESB student participation in the more challenging mathematics subjects at year 12 level.

Finally, in Research Report Number 17 of the same survey (Marks et al, 2000), participation rates in year 12 (1998) of the year 9 cohort of 1995 students whose fathers were born in the six countries from which there has been "sufficient numbers to provide reasonable estimates of participation" were all higher than the participation rate of students whose father was born in Australia (74%). These countries were Greece (82%), Italy (81%), former Yugoslavia (78%), Lebanon (80%), Malta (78%) and Vietnam (93%) (Marks et al, 2000, 25).

In comparing my experience as a student in the 1950s to the LSAY reports concerning mathematics participation in the classrooms of the 1990s, differences and similarities emerged. In my mathematics classroom of the 1950s, the immigrant students and their parents were born overseas in one country. Their first language was not English. Their motivation and achievement levels were high. Their year 10 achievement levels were in the first quartile.

In the results listed in LSAY reports relating to participation of non-English students in year 12 mathematics in the 1990s, the students' fathers were born overseas in a number of non-English speaking countries. The participation of this group in year 12 mathematics was higher than that of students of English-speaking origin and more of them studied two mathematics at this level, which included the most advanced level mathematics, Specialist mathematics. Most students who studied Specialist mathematics recorded high achievement levels in year 9 mathematics. It would seem that high levels of participation and achievement of the Latvian migrants in my 1950s mathematics classroom were still characteristic of mathematics students of non-English speaking origins at the end of the twentieth century.



My thesis, then is derived from these observations. What were the responses of the mathematics educators to the changing student ethnicities over the last fifty years of the twentieth century in Australia's mathematics classrooms? To what extent did the mathematics educators respond? Were there problems associated with the achievement of effective mathematics teaching in these environments? Was there recognition of any advantages in teaching mathematics to a classroom containing students of diverse origins? Were any aspects of mathematics teaching and learning, brought to the mathematics classrooms by migrant students, harnessed by educators? The aim of this thesis therefore, is an investigation of the nature and degree of response, at various levels, of mathematics educators in Australia, to changing student ethnicity in the mathematics classroom over the last fifty years of the twentieth century.

Underpinning this thesis, a parallel study will record the manifestations of an Australian immigration policy which underwent considerable change over the period of study and which was the major source of ethnic diversity in the mathematics classroom. This immigration program began in the 1940's and dramatically changed the statistics of Australia's population throughout the second half of the twentieth century. My own experience as a student had involved one other nationality only, but as the migrant numbers grew and with them the diversity of countries of origin, it became necessary to teach mathematics in classrooms containing large numbers of migrant students with a multiplicity of ethnic origins. In Chapter 6, in which perceptions and strategies of school mathematics teachers are investigated, it will be seen that some of these classes contained migrant students numbering more than 70% of the students in the mathematics class. Some of these classes contained students whose places of birth were as diverse as Poland, Macedonia and Vietnam.

## **1.2 Five million postwar migrants**

In the fifty years since the end of World War 2 in 1945, Australia has seen the arrival of more than five million permanent settlers from countries all over the surface of the Earth. That this has constituted a massive change in the number of Australia's population can be seen in Table 1 from figures of Australian Immigration Consolidated Statistics, AGPS, Canberra (annual) and the Commonwealth Censuses in 1947 and 1996 (in Jupp, 1998, 191). While immigration continued in the period

between these years there were fluctuations in quotas and countries of origin and these will be discussed in more detail in Chapter 2.

**Table 1 – Postwar Australian population characteristics and magnitude**

<i>Birthplace</i>	<i>1947</i>	<i>1996</i>
Aboriginal	87 000 (1.1%)	352 000 (2.0%)
Native-born settlers	6 835 171 (89.2%)	13 491 651 (75.4%)
Overseas-born settlers	744 187 (9.7%)	4 047 802 (22.6%)
Total Australian population	7 666 358	17 891 453

Aboriginal population figures are estimates before 1971. Percentages are of the total Australian population (Jupp, 1998, 191).

### **1.3 Prewar homogeneity**

The population of Australia, which in 1945 numbered approximately 8 million people, was dominated numerically, politically and culturally by people mainly of Anglo-Celtic origin whose ancestors had arrived on its shores firstly as convicts of the British penal system in 1788, then later as settlers and fortune seekers. In the early days of settlement, an estimated 350,00 indigenous people who had wandered over the country for thousands of years before the first arrival of European convicts on Australian shores, lived tribal existences. Their numbers were later decimated by illness and persecution due essentially to a mutual inability of the indigenous people and settlers to come to terms with each other's culture. By the middle of the twentieth century the aboriginal population had become a thinly dispersed people living in widespread localities, whose numbers were not included in government census figures up until the 1960's. For the purposes of this investigation, they have been regarded as the only truly indigenous people of Australia, because of the extraordinary longevity of their presence in Australia. Their story, therefore, is not central to this thesis which concerns the education of relatively recent arrivals of migrant students. However their education and ways of learning and teaching in mathematics have been the subject of much work by other researchers, eg. Bourke and Parkin (1977); Folds (1987); and P. Harris (1980) and, in some sections of this thesis, aspects of their mathematics education will be referenced for comparative purposes.

#### **1.4 Postwar diversity**

In the second half of the twentieth century, Australia's population rapidly became extraordinarily diverse, in the first instance, as a result of the massive program of European immigration instigated by the government after the Second World War. Later migrants from a wider geographical base arrived as a result of other wars, natural disasters and other hardships. Just over forty years later, in relation to the 1991 population census, Australia's people were described as the second most diverse population, per capita, of migrant groups in the world, second only to that of Israel. Some 26% of the then population of 17.3 million people were born outside the country, and a further 30.8% were first generation Australian-born of one or more migrant parents. Many more had varying degrees of lineage traceable to ethnic backgrounds (Hugo and Maher, 1995).

#### **1.5 Social and cultural change in Australia**

It is generally recognised that the rapid change in the ethnic origins of Australia's population through the settlement over the last 50 years of the twentieth century of large numbers of diverse immigrant peoples, was responsible, to a significant degree, for change in social and cultural infrastructures in what had previously been labelled "the Australian way of life". This was described in the Atlas of Australian People printed in 1995 by the Bureau of Immigration Research as follows:

The rate of arrival and composition of the incoming population itself had had an enormous impact on the evolving national character (Hugo and Maher, 1995, 2).

Melluish described contemporary Australia in the following terms:

Contemporary Australia is characterized by the breakdown of these old certainties about nation, race, empire and the Australian way of life. The earlier drive toward homogeneity and unity has slackened considerably. Quite simply the old Australian ideal of a just society founded on a homogenous people sharing a single culture has lost much of its plausibility (Melluish, 1998, 13).

Castles et al concluded:

The peopling of Australia through immigration has been a major defining element in the construction of the modern Australian nation (Castles et al, 1998, 135).

Jupp described post-war Australia and included aspects of positive and negative reactions to change as follows:

Australia is one of a handful of "settler societies" that cannot be understood without placing immigration at the centre of their history and culture. It is certainly not the most multicultural society in the world, but it has been more directly affected by immigration than almost anywhere else. Its successes include the settlement, since 1945, of over five million newcomers, with little social upheaval and much economic success; considerable social and educational mobility in the second generation; the shifting of public opinion from a narrow concept of British Australia towards an acceptance of ethnic diversity; and the creation of a much more varied and adaptable society. Its failures include inadequate training in English; the persistence of White Australia attitudes among many Australians; social problems experienced by less skilled immigrants (especially those granted residency on humanitarian grounds); and the periodic revival of a narrow nationalism that fears change and expansion (Jupp, 1998, 151).

It seems irrefutable, that massive post-war immigration to Australia resulted in significant changes to the lives of the Australian people. How then, did the change in ethnic origins of the children of Australia, impact on the institutions providing their education? More specifically, how did the transformation from a relatively homogenous cohort of students of Anglo-Celtic origin to one of highly varied ethnic origins, over the last fifty years, affect the delivery of mathematics education in the classrooms of Australia?

#### **1.6 The context of the classroom**

The teaching of mathematics in Australia enjoyed a prominent position in the curricula of Australian schools over the period studied in this thesis. Its importance was demonstrated in such areas as large time allocation in the timetables of schools, large numbers of staff, designation as a compulsory study for all students over most of the twelve or thirteen years of Australian education in schools, and recognition as a prerequisite requirement for a large number of tertiary studies. A reasonable expectation in the face of significant changes in the Australian social and cultural environment as a result as immigration, which inevitably permeated the mathematics

classroom, would have been some sort of serious and discernible response on the part of the educators who were responsible for mathematics education in that classroom. The importance of mathematics in the curriculum and my own personal experience of learning in and teaching classroom mathematics in Victorian schools over the period has led to the choice of the classroom as the context of mathematics educator response. This investigation therefore will centre on the application of mathematics educator policies and practice in relation to the mathematics classroom. To what extent did the emergence of significant social and cultural change in the "Australian way of life" in the Australian population generally, which accompanied the influx of migrants, permeate and influence the teaching and learning of mathematics in Australia's classrooms over the period? How did new cultural attitudes migrant students brought with them to the mathematics classroom interlock with the mathematical culture of existing Australian mathematics education? There were a number of points at which response could have been manifested within the classroom. What changes of mathematics educator policy and practice emerged in such areas as classroom environment, resources, curriculum, teaching methodology and assessment? Identification of the classroom as the context of investigation raised a number of questions. What physical and human resources were created or removed?

Who were the mathematics educators and what pathways were available for the manifestation of response in the classroom? Were there difficulties in communication to be addressed? Did teacher practitioners need special training or new resources to cope with immigrant students? Were mathematics educators able to develop or envelop existing migrant mathematical education so that useful continuation could be achieved? Did Australian mathematics educators recognize anything new or different to be learnt about methodologies of the teaching of migrants before their arrival, which they brought to the Australian classroom? Since there is evidence of significant societal and cultural change as a result of migration, was this manifested in the school curriculum generally? To what extent did it involve mathematics curriculum? If the mathematics curriculum changed over the period of the study were these changes related in any way to migrant influx? To what influence were any changes in classroom mathematics over the period attributable? Were changes in mathematics education addressed to any migrant disadvantages in regulatory assessment? Were there any changes in patterns of participation and

achievement standards in classroom mathematics of classroom students? These questions will be addressed in ensuing chapters of this thesis.

Change and response to change over the period of study in this thesis can only be measured in relation to an existing base. In Chapter 2 major aspects of Australian mathematics education in place at the commencement of the postwar period will be described and the scene will be set for the investigation of later responses to the migrant presence in the mathematics classroom.

## Chapter 2

### *Baselines of change and response*

Chapter 2 will present a picture of some of the precursors and evolving factors which provided relevant backgrounds for investigation of the change and response of Australia's mathematics educators to the arrival of post-war immigrant children in the mathematics classrooms of Australia. What were the philosophical benchmarks of Australia's classroom education just prior to the first post-war migration in the middle of the twentieth century and which were still being employed when the immigrants arrived? What was the overall picture of immigration policy and practice over the fifty years of investigation? What major theoretical changes in mathematics education philosophy evolved over the period? What were the main characteristics of aspects in the implementation of mathematics education when the first pre-war immigrant students arrived?

It should be noted that in this thesis the word "post-war" will be used. This term refers to any time after the end of the Second World War (1939-1945).

#### **2.1 Existing philosophies and allegiances**

It will be seen that some features of Australia's life style, in the immediate post-war period, in the general area of education, and in mathematics education in particular, held within them the potential for conflicts. There was the need for relevant, practical and pragmatic mathematics education related to a unique Australian environment. At the same time, an historical attachment to Great Britain, created a desire in Australia's mostly Anglo-Celtic population, to continue to conform to British ideals of education, in which mathematics occupied a more hierarchical and academic position. Historically, the majority of Australians were committed to relatively stable, uniform and egalitarian societal ideals which contrasted sharply with the ideals of an established class system apparent in British education at the time. Simultaneously Australia was embarking on the instigation of one of the largest and most diverse immigration programs in relation to its population numbers that the world has ever seen.

### 2.1.1 Colonial, modern and contemporary Australia

In order to establish the context in which Australian classroom mathematics operated in the 1940s and early 1950s, material from writers such as Clements (1989), Connell (1962), Horwood (1997), Jupp (1998) and Melliush (1998) will be used.

Melliush (1998), writing from an immigration standpoint, divided Australia into three phases since the first white settlers arrived in 1788. Australia in the years prior to 1901 he defined as *Colonial*. Twentieth century Australia from 1901 to the 1960s was described as *Modern* and from the 1960s to the time of his writing (1998) as *Contemporary*. These headings will be used in Chapter 2, particularly in relation to the chronology of educational and school mathematics structures and migration events. Chapter 2, therefore will describe aspects of the existing cultural and societal bases of classroom mathematics in the last decade and a half of *Modern* Australia. The table below summarizes the major migration events of this period.

**Table 2 – Summarized chronology of migration events up to the early 1950s**

	<i>EARLY MODERN AUSTRALIA (1901 to 1940)</i>
up to 1945	
1901	Immigration Restriction Act
1906	Repatriation of Kanakas to Pacific Islands
1914	German and Austrian residents interned. World War 1
1919	Versailles Conference after end of World War 1. Australia upholds White Australia Policy
1922	Empire Settlement Act (UK) to encourage assisted emigration from Britain.
1928	Quota system placed on number of immigrants from Southern and Eastern Europe
1930	Entry of all non-British Europeans banned unless there is family in Australia or wealth
1934	Riots in Kalgoorlie against Greeks, Italians and Yugoslavians and other non-British immigrants
1939/40	World War 2 begins. 'Enemy aliens' interned. The <i>Dunera</i> arrives in Sydney from England carrying mainly Jewish 'enemy aliens'
	<i>MODERN AUSTRALIA AT THE END OF WORLD WAR 2</i>
1945	End of World War 2. The first Commonwealth Immigration Department is established
1946	Assisted passage agreement with the United Kingdom
1947	Thousands of displaced Persons from war-torn Europe start arriving
1950	Good Neighbour Council Movement is launched nationally
1951-55	Commonwealth Nationality and Citizenship Act creates the status of 'Australian Citizen' to take effect from January 1, 1949
1955	Arrival of millionth post-war immigrant

(Immigration events taken from Jupp, 1998, 190)



What were the perceived needs and expectations of Australia's population in the mathematics education of its students and to what extent did these penetrate school mathematics classrooms of *Modern Australia*? How closely did the resulting school mathematics programs relate to the needs of Australian mathematics students when the first post-war migrant students began to arrive in the 1940s?

### 2.1.2 *A pragmatic approach*

From the earliest settlement of Australia firstly as a British convict settlement two hundred years earlier, and later as a place, in the majority of cases, of refuge for disadvantaged people to improve their living conditions, Australia's harsh and unfamiliar environment required ingenuity and inventiveness. The long distances between people on the land imposed a necessity for individualism while the remoteness of the country from the rest of the world conferred a need for mutual co-operation among its people. Horwood (1997) noted that Australia's society had become relatively classless and far removed from the class divisions of the countries of origin of its people who came mainly from Great Britain and Ireland. School education, however, was strongly linked with the tradition in these "old countries" and contained within it a moral dimension, which was at first adopted by the colonial leaders. By the twentieth century however, school education and, in particular, mathematics education, had a more pragmatic appeal. Connell explained:

...so we have from the beginning of our secondary school history, a utilitarian motive pigmenting the purity of our classical tradition (Connell, 1962, 27).

Business enterprise was seen as the avenue to a successful career and much of the value of mathematics was seen in its application to business practice in a wide variety of situations. The curricula of Australian secondary schools were influenced by the curricula of non-conformist academies which had successfully attracted English and American students in the nineteenth century. Connell stated:

These catered in large part for the commercial classes, and though they, too, basically taught a classical curriculum, they introduced some subjects of immediate practical value for the sons of commerce (Connell, 1962, 27).

Separate and largely arithmetical courses were studied by the stream of "commercial students" in Australia in the government secondary schools of the mid-twentieth century. These courses in mathematics, in the experience of this researcher as a student in a government school of the 1950s, were peopled, largely by female students who would seek employment, around the age of seventeen, in such enterprises as banks and business offices on the completion of year 10. Perhaps there was some lack of conviction about this study for male students. Mathematics education in terms of its practical application may have represented a contradiction in terms of other, loftier values, inherited from Britain, related to a more elitist academic attitude to mathematics. Thus the need for pragmatism was only one of the concerns about mathematics education. What were some of the others?

### 2.1.3 *A European, preferably British, model*

The largest contingent of migrants in the first years of post-war immigration came to Australia from Great Britain and Ireland. Various documents were issued to British migrants by the immigration authorities based at Australia House in London. In the last years of *Modern* Australia British migrants would have read the following:

A welcome awaits.....

You will discover some differences in our way of living.....But the differences are small compared with the similarities. You and we have a common ancestry, a common heritage, a common tongue. We have the same Queen. We fly the Union Jack in our national flag. With you we inherit and cherish the great wealth of English literature. Your history is ours. Our forefathers fought in Agincourt and Trafalgar alongside yours just as we fought beside you in Passchendaele and El Alamein.

In Australia you will never be far from your original home.....And no matter where you go in Australia you will be among friends....

Booth Collection, 1956, Museum of Victoria

and

Remember that schooling is compulsory...They (your children) will find the schools and the lessons very much the same as they were used to.

As schooling in Australia is similar in pattern to that of England, your children will feel at home in Australian schools...Tens of thousands of children from the

United Kingdom have come to Australia and have settled into their places in classrooms with little, if any, disruption of their training (Department of Immigration, Australia House, pamphlet (1955) in the Booth Collection (1956).

At the time of issue of the above documents, Australia's millionth migrant had arrived. None of the migrant students who arrived in the researcher's country high school in the early 1950s, as described in Chapter 1, spoke English as a first language. For some migrant students, the language and education presented in Australia's schools was very unfamiliar. The researcher could not locate information issued to non-British immigrants.

Thus, despite the growing sense of nationalism particularly around the time of Federation in 1901 and some shifts away from traditional colonial values, Australians still referred to Great Britain as "home". The desires of the people and educators were for an education in keeping with the mainly British origins of its population supported possibly by some pragmatism related to substantial trade agreements with Great Britain. Clements described the close connection of Melbourne University to the British education system as follows:

.....desiring to make sure that the University of Melbourne's courses would be seen to be equal to those at "home" (Clements 1989, 18).

Clements noted that, in the late nineteenth century the suitability and relevance of Euclid was questioned in Australia because of the need to make mathematics a subject accessible to the majority of students. In 1876 The Council of Melbourne University rejected a recommendation of the Professorial Board to change "Euclid" to "Geometry" and the use of a textbook which was more suitable than Euclid's "Elements". Clements commented:

Euclid was allowed to retain his firm grip on school mathematics in Victoria for another quarter of a century (Clements 1989, 26).

It was not until the British universities of Oxford and Cambridge accepted radical change in school mathematics classes that The Royal Commission into the University of Melbourne, held in 1904, stated that matriculation mathematics should be brought into line with British reform and Melbourne and other Australian universities

removed the requirement of Euclid in Geometry. Clements described this need as follows:

The greatest influence, on colonial educational administrators at least appears to have been a desire to keep up with developments in other places, especially Britain (Clements, 1989, 18)

However, despite the discrediting of Euclid, it continued to be taught in parts of Victoria, and the researcher clearly remembers its presence in the Year 10 mathematics curriculum of a small country high school in the 1950s. The reason for this retention is not clear but speculation could lead to the notion that teachers, by this time, locked into a centralized system which will be described later, may have furthered their own agendas in the classroom in the face of their lack of opportunity or motivation to participate in the policy, planning and assessment procedures of school mathematics courses. Butts wrote:

Thus it was assumed that only a few persons within the professional staff were qualified to make real educational decisions. The vast majority of teachers and headmasters of schools were largely excluded from this group. Professional decisions were basically confined to head office and to the top officials in head office (Butts, 1955, in Horwood, 1997, 63).

Perhaps, as Melliush suggested, teachers retained Euclid because they still believed in the traditional attitudes and curriculum of Britain which they had administered to their students in the first half of the twentieth century. Melliush commented:

Australians were not forced to be British; they simply wanted to be British.....  
Britain was the ultimate reference point (Melliush, 1998, 12).

Thus adherence to British educational curriculum continued into the second half of the twentieth century and in mathematics education textbooks were used, which were wholly published and printed in Great Britain. In the year 1952, the researcher's own text-books in Year 12 Applied Mathematics in country Victoria were volumes 1 and 2 of "A First Course in Mechanics" written by W. G. Borchardt, (1950). The information on its frontispiece is illustrated in the following reproduction:

# **A FIRST COURSE IN MECHANICS**

**BY**

**W. G. BORCHARDT, M.A, B.Sc.**  
FORMERLY ASSISTANT MASTER OF THE MILITARY AND ENGINEERING  
SIDE AT CHELTENHAM COLLEGE  
AND SCHOLAR OF ST. JOHN'S COLLEGE, CAMBRIDGE

**SEVENTH IMPRESSION**

**THIRD EDITION**

**RIVINGTONS**

**34 KING STREET, COVENT GARDEN**

**LONDON**

**1950**

At the commencement of World War 2 in 1939 Australians demonstrated their attachment to Great Britain by participating in the defence of Great Britain as members of the allied forces against Germany. The last years of World War 2 after 1941 saw the forces of the United States of America playing a significant role in the defence of Australia against Japan. Large numbers of American troops were based in Australia, Australians were recalled from the European front, and the two countries fought together in the Pacific region. After the defeat of Japan, the American occupation of Japan was highly influential in the reshaping of Japanese education, particularly mathematics education, and even to the end of the twentieth century this

still lingers in the structures of Japanese schools (Howson, 1991). Was Australia similarly influenced? The theatres of war in the countries of South East Asia would surely have emphasized their geographical proximity to Australia. Where did Australia measure its educational endeavour in the face of the old alliance with Great Britain, a newer alliance with the United States of America and its new experiences in South East Asia? During the first half of the twentieth century Australians wanted an education system which reflected Australia as a white European country with respectable status in the eyes of Europeans, despite their accessibility and close geographic proximity to South East Asia (Hughes, 1987). It will be shown later, that the universities of Australia at this time exerted enormous influence on the content of school curricula through their control of assessment instruments and that they were deeply concerned that Australian qualifications were acceptable in Europe, especially in the higher status degrees such as Medicine and Law.

The inclination of the Australian universities therefore, was to introduce reforms in schools which were in keeping with European countries, particularly with Britain. As has been shown earlier in this chapter, in the first waves of post-war migration British migrants were the most numerous. This attraction towards Europe and the resulting anglicized education raises the question of whether the mathematics curriculum available in Australian schools in the 1950s was, in fact, more favourable to the first migrant student arrivals than to the Australian students themselves. Later arrivals of European migrants, such as southern Italian students, who had little formal or classical education, may have felt disadvantaged also. The nexus between advantage and disadvantage of immigrant students in mathematics education will be revisited later in this thesis.

#### *2.1.4 Belief in a benevolent government*

In *Modern Australia*, until the World War 2, the ancestry of the great majority of Australia's population derived from England, Scotland or Ireland. The resulting Anglo-Celtic population was ethnically and socially homogenous and anxious to retain the traditions and structures of Great Britain. This uniformity of purpose,

impacted on education in Australia. Maclaine described Australian education as follows:

There is a singular degree of uniformity in the pattern of Australian education – in its administrative organisation, its system of schools, its curriculum content and its methods of instruction (Maclaine, 1974, 4).

Thus the need for uniformity was dovetailed with the centralization of education in each state. Put into practice in 1901, this combination resulted in the deployment of significant decision-making within a state bureaucratic central office. Centralization was associated with efficiency. The school mathematics courses of the State Education Departments were characterized by standardized courses and inspectors were appointed to monitor the implementation of these and teacher performance. Thus decisions related to the teaching of school mathematics were the province of the central administration. Changing these was not easily within reach of teachers, much less parents and students. Up until the war the nature of Australia's settlement involved immigrants mostly lacking financial and other resources, which conferred on the population a belief that the government would provide social services and financial assistance. Shaw describes this:

The whole Australian community has been bred on this tradition of relying on the Government (Shaw in Horwood, 1997, 67).

While this attitude contributed to satisfaction with centralization and the resulting uniformity of State education, another factor consolidated its implementation. Australians had developed an egalitarian outlook possibly due to a lack of an established ruling class in its early settlement. The sentiment of equal opportunity for all was strongly felt and concern for the "struggler" resulted in the expectation that the government should assist. Free secular and compulsory state education was a manifestation of this ethos and despite all the concern for parity and connection with British education, it represented a significant divergence from British education practice.

However, this determination to offer all-inclusive opportunities to students through a uniform free and centralised school system and which permeated all aspects of Australian life, has been seen by several writers to have fostered complacency and

lack of progressive and creative development. Jupp, in his description of the late *Modern Australia* into which post-war migrants arrived commented:

Australian culture was congealing into a set mould. Without the dynamics provided by cultural diversity and individualism it simply lacked the stimulus to develop. But in the long term the emphasis on restriction implied in protection and immigration restriction had debilitating consequences.

Australia pursued the goal of a modest level of comfort and took pride in the achievements in this area. However, it paid the price of remaining satisfied with an inward-looking spirit and a closed culture. The feeling of pride and power which protectionist nationalism promised degenerated into a self-satisfied complacency more concerned with preserving what was had already been achieved than with reaching out for new goals (Jupp, 1998, 12, 13)

This clinging to British structures and standards, while answering a need of Australia's people, hindered negotiation and involvement of Australian educators in the formation of Australian education, including mathematics education, and served to extend the uniform long-held connection, endorsed by Australian universities, with British school curriculum, content and assessment. Post-war Australia witnessed the large scale recruitment of British university and teaching personnel at the time of arrival of vast numbers of migrants of diverse origin in the 1950s (Horwood, 1997). As the universities were heavily involved in the implementation of areas of education which included course construction and assessment of school mathematics at secondary level, this recruitment perhaps prolonged Australia's need to retain its ethos of familiar 'Britishness' and the uniformity of its pre-war and wartime education.

It will be seen in later chapters that, eventually, other countries exerted influence on school mathematics such as the United States in the second half of the twentieth century. However, in the period just prior to the onset of post-war migration, the region of the world to which Australians were looking for benchmarking their own educational system was Europe and in particular Great Britain. At the same time there was a need for pragmatism and suitability to the unique environment of Australia in school mathematics and this need could, by definition, only emerge from Australian sources. The need to preserve the homogeneity of Australian society was



strongly linked with traditional ties with Britain and the search for cohesion in earlier settlement days. While this meshed neatly with an existing centralized bureaucratic administration of education, another Australian desire, which was not so prevalent in British education, was for a government which recognized an obligation to provide "a fair go" for all the citizens of its egalitarian society. When this was translated into the needs of school education it meant the provision of the same resources for all students. This conferred a remarkable uniformity and homogeneity on school mathematics education to which change and innovation could not easily be administered, particularly as a result of teacher involvement or parental concern. Later in the century different mechanisms of change emerged, some of the connections so firmly entrenched faded, and a more Australian curriculum emerged. However, it has been argued by writers such as Clements (1989) that, at the time of the first arrivals of post-war migrants, mathematics education, in the hands of the centralized State Education Departments, had been characterized by relative inertia, complacency and reliance on Britain to provide the basis of its curriculum.

However, over the next fifty years of post-war mathematics education, two changes occurred which were relevant to Australian policy and practice. The first was a changing immigration program which was responsible eventually for a highly diverse enrolment of immigrant students in schools, thereby changing the culture of the classroom. The other was a theoretical development in the latter part of the twentieth century, which challenged previously held beliefs that mathematics education was an abstract discipline remote from cultural influences. What were some of the changes in patterns of immigration in post-war Australia?

## **2.2 Some migrant statistics**

Post-war immigration policies and implementation in Australia have a place as one of the most significant events in Australia's history in its twentieth century history. Hugo and Maher described its importance in the following words:

Of all the manifold aspects of Australian contemporary society that differ from the pre-war period, none is more striking than the nation's rapid transition to a multicultural society. So rapid has the change been that some sections of the community and some of our institutions, structures and services have not

adjusted in terms of meeting the needs of a more diverse and ethnically complex society (Hugo and Maher, 1995, 5).

In the following sections some of the dimensions of immigration over this period will be summarized. The figures do not extend beyond the early 1990s but in the more detailed statistics used in Chapter 5, some later figures do appear.

### 2.2.1 *Migrant arrivals*

Post-war Australia accepted in excess of 5 million immigrants but the rates of intake varied considerably on an annual basis as is demonstrated in the following table.

**Table 3 – Immigration trends 1948/49 – 1988/89 \***

Year of intake	Troughs	Peaks
1947/48	40 000 – 60 000	
1948/49		180 000 – 200 000
1953/54	80 000 – 100 000	
1955 /56		120 000 – 140 000
1961/62	60 000 – 80 000	
1969/70		160 000 – 180 000
1975/76	40 000 – 60 000	
1981/2		100 000 – 120 000
1983/84	60 000 – 80 000	
1989/90		120 000 – 140 000

\*Adapted from *Australian Immigration Consolidated Statistics* figures in Easson, 1990

It can be seen that there were peaks in intake in the early 1950s, around 1970 and to a lesser extent in the early 1990s. These peaks were followed by troughs, most markedly in the mid-1970s, and in 1992 and in 1993 (Jupp, 1998). Arrivals therefore varied considerably over the period of study. What were some of the reasons for this fluctuation? Were there also fluctuations in the origins of migrants?

### 2.2.2 *Changing patterns of ethnicity*

The peak between 1948 and 1952 was made up primarily of European-born immigrants the largest contingents coming from Great Britain, Greece, Italy and Yugoslavia. The first Immigration Minister, Mr Arthur Calwell, had pledged his support of the white homogeneity espoused by the White Australia policy. However as the 1950s progressed immigration became less linked with population politics and was seen as a way of removing labour market shortfalls. The next big peak between

1963 and 1974 was connected with the liberalization of entry requirements by the then Minister, Mr Harold Holt. With it, the last vestiges of the White Australia policy began to disappear in favour of an explicit policy aimed at the provision of a reservoir of personnel suitable for the growing technological nature of manufacturing. In subsequent years of immigration business prowess and a related knowledge of technology were valuable attributes in migrant applications.

During later immigrant expansions therefore, the composition of intake changed considerably. In 1966 there were few Asian countries listed in the top ten sourced countries of new settlers in Australia. Ten years later Malaysia and the Philippines ranked fifth and sixth among the top ten sourced countries. By 1986 the majority of the top ten sourced countries were Asian with the highest numbers coming from the Philippines, Vietnam, Malaysia, Hong Kong and China as illustrated in the following table.

**Table 4 – Top ten sourced countries of birth**

Countries are listed in order from the highest to the lowest contributors of immigrants to Australia.

1966 – 67	1976-77	1988-89
UK and Ireland, Italy, Greece, Yugoslavia, Germany, New Zealand, USA, Netherlands, Lebanon, India, Other countries combined.	Other countries combined, UK and Ireland, Lebanon, New Zealand, Cyprus, Malaysia, Philippines, Yugoslavia, Greece, Italy, USA	Other countries combined, UK and Ireland, New Zealand, Philippines, Vietnam, Malaysia, Hong Kong, China, India, South Africa, Sri Lanka

\*Adapted from *Australian Immigration Consolidated Statistics* figures in Easson, 1990

### 2.2.3 Geographical patterns of settlement

Where did these migrants settle in Australia? According to the results of studies of regional population growth in Australia from 1986 to 1991 during which time the national population grew from just over 16 million to 17.3 million the locations of migrants were unevenly distributed. Significant settlement took place in just a few locations, predominantly within two states, Victoria and New South Wales. In 1993 these two states accommodated 73 per cent of all immigrants, considerably more than the 60 per cent of the national population who lived in them. The Australian Bureau of Statistics (ABS) estimated that more than 80 per cent of immigrants to Australia

have settled in the five largest cities and that 60 per cent have located in Sydney or Melbourne. Migrant students therefore were concentrated largely in relatively small areas which are urban and densely populated (Maher & Stimson, 1994). Access to migrant students could not have presented difficulties in terms of a supply of educational resources.

The second issue of importance to mathematics education was a change of direction in the theoretical perspectives which resulted in the appearance of research publications of the 1980s. These publications identified cultural factors as significant in the achievement of understanding in mathematics education. Had this link, perceived by researchers, between culture and effective mathematics education, been recognized and responded to by Australia's mathematics educators in their policies and practice in the face of cultural diversity within their own classrooms due to immigration? In the next section elements of these changed theoretical perspectives will be examined. This research into the connections between culture and mathematics was international and took place over the 1980s and 1990s. Research conclusions related to cultural connections with mathematics education will be revisited in the investigations of the responses of mathematics educators over these years.

### **2.3 Changing theories in mathematics education**

Ernest wrote:

For over two thousand years, mathematics has been dominated by an absolutist paradigm, which views it as a body of infallible and objective truth, far removed from the affairs and values of humanity (Ernest, 1991, xi).

However, according to Ernest, this absolutist viewpoint was challenged in the twentieth century. Set theory, in particular represented a challenge whereby a set could be created from the extension of any concept. The emergence of contradictions in set theory and other areas such as the theory of functions raised further questions.

Ernest wrote:

The outcome of this crisis was the development of a number of schools of philosophy whose aims were to account for the nature of mathematical knowledge and to re-establish its certainty (Ernest, 1991, ix).

### *2.3.1 A new view of mathematics education*

Through an examination of a number of different philosophies Ernest described views which challenged the description of the nature of mathematics as certain, absolute and neutral. He described mathematics as being fallible and socially constructivist and in his discussion of mathematics education concluded in the words of Thom:

whether one wishes it or not, all mathematical pedagogy even if scarcely coherent, rests on a philosophy of mathematics (Thom, 1971, in Ernest, 1991, 296).

Ernest identified groups which adopted particular ideologies related to the nature of mathematics. He exemplified The Old Humanists, a group with ideologies traceable to those of Ancient Greece, as a member of the Purist ideologies within absolutist philosophy (Ernest, 1991). In his description of The Old Humanists group Ernest described central elements of Humanist doctrine as follows:

Thus knowledge is seen to be objective and independent of human and social values and concerns (Ernest, 1991, 169).

and described Humanist philosophy in the following terms:

.....education and knowledge are a good, an end in themselves, and not a means to a baser, utilitarian end (Ernest, 1991, 172).

The perspective of the epistemology of this old humanist ideology included plurality of points of view and, in the structure, grounds for analysis, comparison and evaluation. There was a valuing of logic, rigour and purity and a view of knowledge as a pure, neutral and value-free entity. According to Ernest, as late as 1938, mathematics education in Great Britain was still imbued with humanist ideology. Ernest quoted an expression of belief in a Ministry of Education Report as follows:

We believe that school mathematics will be put on a sound footing only when teachers agree that it should be taught as art and music and physical science should be taught, because it is one of the main lines which the creative spirit of man has followed in its development (Ministry of Education, 1858, in Ernest, 1991, 176).

In practice this absolutist, purist philosophy as a basis for school mathematics led to exclusion of many students and a mathematics direction, which was designed to suit the relatively few students who were aiming at university education. Furthermore it presented mathematics, in the words of Ernest (1991, 180) as "objective, external, cold and remote".

At first glance the relationship between the underlying policies at work in nineteenth and twentieth century English mathematics classroom, and their basis in Platonism and ancient Greek thought, may seem remote from mathematics education practice in Australia on the other side of the world. However, it was seen earlier in this chapter that the educational philosophy of Great Britain exerted an enormous influence on the mathematics classrooms of Australia and that this was evident in mathematics education up to and beyond the time of the first arrivals of post-war migrants. Years later in the 1970s and 1980s, various different approaches leading to more culture-related mathematical curricula in Australian schools were researched, and these resulted in the implementation of significantly different aspects of curriculum such as problem solving. It is the concern of this thesis to consider how Australian educators, whose culture, over this period, was undergoing upheaval as a result of enormous change in the ethnic backgrounds of the population responded to the diversity of origins and cultural heritages of the students in its mathematics classrooms.

### *2.3.2 Cultural connections in mathematics education*

In the 1980s, the importance of cultural context formed a central theme in a number of mathematics education research projects. Abraham and Bibby wrote:

For the old humanists, mathematics had no apparent relationship with society at all. For the industrial trainers, mathematics has a narrow one-way relationship in which mathematics is required to provide the techniques and expertise demanded by particular interests created through technological change and industrialisation. Neither group sees mathematics and society as having an interactive relationship. The public educator perspective, however, takes a somewhat more interactive approach in that the kind of mathematics which is seen as appropriate for the curriculum is built on a view of society which takes account of different constituencies of interests, including the cultural interests of the learner (Abraham and Bibby, 1988, 3).

Later in the century different school structures were introduced and cultural connections with mathematics teaching and learning were researched. Bishop in addressing cultural conflicts in mathematics education wrote:

Within the last ten years, there has been an increasing move to make mathematics accessible to all learners; there has been an increasing questioning of the relevance of ex-colonial models of education in developing countries, and in countries with indigenous "minorities"; the social dimension has come into greater prominence in research in mathematics education; and the cultural nature of mathematical knowledge has become clearer to many mathematics educators (Bishop 1994, 15).

The place of research in the investigation of Australia's response of its mathematics educators to the migrant students in their classrooms will be treated in more detail in Chapter 3. The introduction of significant numbers of migrant students into the mathematics classroom brought to it a new social and cultural climate. If Australian educators at the time had accepted the existence of connections between this new cultural environment and mathematics learning, a response through relevant changes in teaching techniques in mathematics would have been a reasonable expectation. In the international scene cultural changes in the teaching of mathematics have been implemented in a number of different ways, not necessarily related to mathematics education research.

### *2.3.3 International experiences in mathematics education*

There have been examples of draconian measures taken by governments and teaching authorities around the world, usually in some critical political situation, whereby education emanating from an "alien" culture has been wholly imposed on school children. One such measure was described by Swetz in 1978 who described the wholesale imposition of Russian mathematics curriculum, complete with its texts and resource material, on the population of China after the communist revolution which

had left China's education system in a chaos of illiteracy and lack of numeracy. Swetz wrote:

Under the popular slogan "learn from the advanced experience of the Soviet Union," a complete emulation of Soviet teaching policy and educational philosophy began. This emphasis resulted in" the polytechnicization of higher education, a massive translation of Soviet texts and teaching plans, and a large scale exchange of students and educational advisors with socialist allies. Official teaching plans for the year 1953 adopted the contents of Soviet middle school outlines *in toto*.....(Swetz, 1978, 136-137).

Subsequently the desperate problems of the education system in China were overcome and one immediate reaction was the rejection of Russian resources and mathematical teaching methods on the basis of their cultural unsuitability for Chinese students and Chinese educational goals. Swetz wrote in reference to Chinese education when Mao Tse-tung came into power:

The year 1958 ushered in the "Great Leap Forward,".....pride in the achievements of their young socialist state, together with a growing realization that a continued perpetuation of Soviet educational practices would produce a cultural alienation of China's youth, compelled educators to reject Soviet influence (Swetz, 1978, 141).

In post-war Japan, occupied by the allied forces, the American government machinery initiated and monitored schools based on an American model. While visiting mathematics classrooms in Japan and observing that students worked within curricular guidelines and structures of American schools, Howson noted that the Japanese were creating an impression only of adopting American mathematical models for the benefit of the American authorities (Howson, 1991). Japan never returned fully to its old elitist system of mathematics education and absorbed some of the structures of American schools but, by the end of the twentieth century, marked differences have opened up in such aspects of education as philosophy, curriculum, school culture, achievement objectives, transitions to further education in the education systems of both countries. Ironically, research has taken place in America at the end of the twentieth century into aspects of the Japanese mathematical education because of a concern for a perceived decline or inadequacy in achievement standards of American students compared with the expertise of Japanese students.



In the progress report concerning their research into how children learn mathematics from classroom instruction, Stigler and Perry (1990) reported on the use of cross-cultural comparison techniques which involved the teaching of mathematics to students in different "styles" derived from two ethnically different countries (Stigler et al, 1990). Their interest in this comparison stemmed, to some extent, from the fact that efforts were being made by American education authorities to improve the academic achievement of American students whose standard of performance in mathematics was seen to be well below that of Japanese and South East Asian students. The US government, concerned that the results of American students were more variable than those of Japanese students and that Asian schools generally produced high achieving students across broad segments of their population, sponsored research into the processes through which children learn mathematics.

As part of this research Stigler et al (1990) investigated the ability of American students to change their processing methods as a result of being taught mathematics in the Japanese 'style' by an American teacher. Aspects of Japanese 'style' which differed significantly from American 'style' included lesson structure, classroom discourse, the role of the teacher and the pace of instruction. Along one line of investigation, selected mathematics topics were taught in parallel classes by an American trained teachers using videotape, one according to normal American practice and the other to normal Japanese practice, the hypothesis being that the difference in structure, classroom discourse, teacher's role, and pace, that is, the difference in classroom cultures, led Japanese students to process lessons differently than American students. The ability of American students to exhibit difference in their mathematical processing methods as a result of the two different classroom cultures operating in the two different 'styles' was monitored.

The findings of Stigler et al (1990) did suggest that there were differences in performance in common post tests administered to the students of American-style and Japanese-style classroom settings related to mathematical processing, which the researchers attributed to cultural influences rather than to mathematical knowledge. However, perhaps consideration should be given to the artificial setting of the experiment.

Internationally there has been a response for different reasons and in different environments to the role of cultural difference in mathematics education. Earlier in this chapter it was noted that, despite the close ties and inheritance of British values from colonial times, the principles of British education in mathematics did not always serve the needs of Australian students in the immediate post-war period. How did Australia's mathematics educators in their turn respond to the different cultures brought to the mathematics classroom by post-war immigrant students? What were their responses to the multiplicity of ethnicities within their mathematics classrooms?

#### **2.4 Research questions**

As a result of student and teacher experience in the mathematics classroom, the researcher has been stimulated to examine some of the interactions between immigration and classroom education in mathematics. Australian school education has undergone many changes over the fifty years of the post-war immigration, which is the catalyst of investigation in this thesis. The use of the mathematics classroom as a basis for investigation can be justified by its continued existence as one of the constant structures of school education over the period. Other areas of study in schools have vanished from the school curriculum, notably in the Humanities, or have been modified or renamed so that to follow their progress over fifty years is a difficult task. Mathematics as a subject of study has retained a constant and prominent place over the period. There is no doubt also, that throughout the period of study it has functioned as a prerequisite for an increasing number of studies at tertiary level. Throughout the period of this study there has been relatively little change in the role of the classroom teacher as the principal figure engaged in school mathematics education. However, that is not to say that aspects of mathematics classroom education have not changed. Changes have occurred at different rates and to different degrees of innovation in the mathematics classroom in its environment, resources, teaching methodology, curriculum and assessment. Calculation aids have ranged from logarithm tables, through slide rules to calculators and computer technology. The relatively short adoption of New Math(s) in the curriculum of the 1960s provided a contrast with the introduction of Problem Solving, which began in the late 1970s and which still constitutes a major element in the curriculum of classroom mathematics classrooms of the twenty first century. A variety of mathematics

assessment models have been introduced throughout the period of study. These changes have not occurred in a social vacuum. Earlier in Chapter 2, in the 1950s, the close connections between Australian and British values and Australia were emphasized by highly emotive literature used to entice British immigrants to come to Australia. This was a ramification of the desire of the then government to retain the White Australia Policy and the need to cling to the British values of the population of Australia.

Immigration in Australia is highly political and has been determined, through the government in power, by the Federal Minister of Immigration, and the implementation of policy has been managed through the Federal Department of Immigration over most of the period of study. Education in Australia over this period was primarily the responsibility of the States but during the period of study, the Office of Education of the Commonwealth Government became the Department of Education responsible to its own Minister of Education. It would seem inevitable that interactions of these political structures flowed into all aspects of classroom education. In Chapter 2 underlying bases of cultural, political and academic activity relative to classroom mathematics at the beginning and during the period of study were described. The tension between the constancy of the figure of the mathematics teacher in control of the mathematics classroom and the plethora of different external influences impinging on mathematics education from a number of directions therefore is the underlying base of this thesis. The researcher has chosen to investigate this tension through the mechanism of researching the responses of mathematics educators to the presence of ethnically diverse students within the mathematics classroom. The first question to be addressed concerned the definitions of ethnic difference in Australia's student population.

- (1) Who are the students who form the bases of comparison in defining ethnic difference? The terminology used in immigration, educational and research literature has changed over the period of investigation. Even census figures have used different definitions over the fifty years of the study. The word 'ethnic' was used for many years in common Australian parlance as a noun. What did the word 'Australian' mean when many immigrant students became Naturalized Australians but remained immersed in their own traditional

cultures? During the period of study various catch words had been devised to describe various periods of immigration policy which were then incorporated in education literature. Words such as 'assimilation', 'integration' and 'multiculturalism' were commonly used as headings without definition. Some clarification of terminology has been necessary.

- (2) What research had taken place in the area of mathematics education in relation to ethnicity? What were the major preoccupations of research in mathematics education over the period? What was the context of Australian research into classroom mathematics and the ethnically diverse classroom?
- (3) Who were the mathematics educators in the structures of school education responsible for intentional policies and practical implementation over the period of study? What data could be researched about their activities in mathematics education? What were their links with immigration policies and management? How could the changing patterns of immigration which were responsible for the ethnicity of the student cohort be linked to aspects of classroom teaching of mathematics?
- (4) What were the major points of focus in mathematics education over the period of study? What were the sources of new directions of mathematics education in the classroom?
- (5) What responses in policy and practice did mathematics educators make to the influx of students of diverse ethnicity, which were discernibly enacted in their mathematics classrooms? To which needs and attributes of migrant students were these addressed?
- (6) In what ways did any direct responses to immigrant presence by the mathematics educators at different levels of educational control generally interlock and complement each other?

In the structure of this thesis, Chapter 3 will address the complexity of definitions related to immigration terminologies which penetrated educational documentation. It

will also contain a review of research related to the questions of ethnicity and mathematics education and the difficulties and issues related to the context of Australian research.

Chapter 4 will describe the two categories of mathematics educators used in this thesis. These were the macro educators responsible for intentional policies and their management and the teacher practitioners who implemented mathematics education within their own classrooms. While both federal and state government authorities were responsible for mathematics policies, discussion of their activities will centre on the State of Victoria as a representative state. The selection of sources of data, documents and publications related to macro educators, and questionnaire and personal interview related to perceptions of teachers will be described in Chapter 4.

Chapter 5 will present the results of investigation of data related to response of the macro educators through the use of documents and related literature in the context of the major mathematical changes in each of the five decades of the period of investigation. A parallel chronology of immigration events within each decade will also be presented.

Chapter 6 will present the research structures and results of questionnaires and personal interviews which were used to investigate the perceptions of response of a group of Victorian teachers.

Chapter 7 will synthesize the research findings of both intentional policies of the macro educators and the perceptions of teachers of the implementation and will investigate the connections between these two sets of responses.

In 2001 Australia is still accepting immigrants. However in the twenty first century, the large number of legal and illegal immigrants to Australia requiring entry on the grounds of humanitarian aid, particularly those from Middle Eastern countries, has challenged official immigration laws and selection procedures, provoking drastic control measures by the Australian Federal government. It seems certain that immigration to Australia will continue. Mathematics education, in 2001, remains a prominent study in the curriculum of Australian schools. The researcher believes that

observations of the policy and practice in the implementation of classroom mathematics over the last fifty years of immigration, and evaluation of past experiences, will make valuable contributions to Australian mathematics education in future years.

## Chapter 3

### *Complexities and issues in migrant research*

This thesis is a socio-historic investigation of the reaction of Australia's mathematics educators to the ethnically diverse population of students in the mathematics classroom between 1950 and 2000. The changing sources of ethnicity in the student cohort were a product of a continuing immigration policy of Australia which began in the immediate post-war period and which attracted very large numbers of immigrants from all over the world. In the last twenty years of this period the importance of cultural factors in promoting the understanding of the teaching and learning of mathematics concepts was recognised in international mathematical education research. An early description of cultural importance in mathematics education was described by Fasheh in the following words:

The article points ..... to the importance of using cultural and societal sources and personal experiences in making the teaching of mathematics more effective and more meaningful, as well as to the ways in which mathematics can be used to deal with some drawbacks in one's own culture and society (Fasheh, 1982, 2).

International endorsement by an influential assembly of mathematics education researchers of the critical nature of culture, values and beliefs to the teaching and learning of mathematics, followed. Research into the mathematics education of different ethnic groups became a subset of research into cultural connections with the learning of mathematics.

Chapter 2 described a number of aspects of Australian educational and societal backgrounds from which research questions emerged. These aspects included details of the immigration policy which affected the classrooms of Australia, a picture of the mathematics education provided for the then relatively homogenous Australian population just prior to the onset of this immigration, an historical background of the philosophy of mathematics education, and some politically driven cultural experiments in international mathematics education. In Chapter 3, some of problems and obstacles which obscured the investigation of the researcher into the responses of

Australian mathematics educators to the presence of ethnically diverse students in the classroom will be considered, together with a review of related international and Australian research.

### **3.1 Ethnic and cultural diversity**

Cultural diversity only becomes a reality when members of cultures interact (Melluish, 1998, 49).

Melluish noted that although there has been an extraordinary increase in the number of ethnic cultural groups in Australia because of a sharp increase in immigration to its shores since 1945:

It is difficult to point to one major modification that these ethnic cultures have wrought in mainstream Australian life.....the culture transferred from ethnic sub-cultures has lacked a significant element of high culture (Melluish, 1998, 48).

Melluish cautioned against the over-emphasis of the ethnic component of cultural diversity because he saw change already taking place in Australia before the first immigrant arrivals in 1945. At this time Australia was relatively ethnically homogenous. He contended that this change, which represented an evolution in society from tribal loyalties, tradition and habit to a more anonymous society, was already taking place through occupational mobility and demographic change.

However immigration to Australia was relatively sudden and of sufficient magnitude to change dramatically the cultural environment of the school classroom. Thus the researcher has chosen to investigate its impact on mathematics in Australia's schools which may or may not equate to the "high culture" referred to by Melluish.

That the government policy which resulted in the acceptance of five million post-war immigrants in the last fifty years of the twentieth century, and which is continuing in the current first year of the twenty first century, has impacted on Australia's schools and classrooms is undeniable. The period of study investigated encompasses major waves of continuous post-war immigration although the rate of acceptance and the mixture of immigrant sources over this period have varied. Two waves of



immigration, one around 1950 and the other around 1970 are noticeable because of their magnitude.

In setting out to investigate the response of Australia's mathematics educators to the presence of significant numbers of students of diverse ethnic origins in the classroom, problems arose in the establishment of appropriate collective terminology for the various ethnic groups and individuals within teaching and student populations. This chapter begins therefore with a consideration of these problems and the selection of a working terminology given a plethora of terminology in popular, official and academic usage. The word "migrant" used most frequently in common Australian parlance in relation to Australia's immigrant population, and to some extent in government education documents and research writings, was initially selected for use in this thesis. However, on examination, it has been found to present inconsistencies, particularly when used by practicing teachers. Similarly conflicts exist between immigrant statistical terminologies such as "ethnicity", "citizenship" and "place of birth". The parameters of "culture", a major focus in this thesis, and the meanings of two catchwords relating to Australia's immigration policies viz "assimilation" and "multiculturalism" will also be explored.

### **3.2 Difficult definitions**

P was born soon after his parents arrived in Australia from Italy in the 1960s. Now, thirty years later, he speaks both English and pure Italian fluently but could not speak any English when he first attended school in Australia, despite the fact that he was born in Australia. The language spoken in his home has always been Italian with a few words spoken in English.

P now holds dual nationality with Australian and Italian passports. His father, whose nationality was classified in Census Year Books as Southern-European-Italian, came from the Italian city of Udine in the province of Giulia-Venezia-Friuli, close to the cosmopolitan city of Trieste and to the border of the former Yugoslavia (Slovenia). After thirty years in Australia P's father speaks English well. He also speaks pure Italian and a language native to Udine which has a written form and is not considered a patois, has obscure origins and is used by relatively few people.

P's mother was born in Alexandria. Her nationality was classified in the Census Yearbook as North African-Egyptian. She attended French school in Egypt. She can communicate fluently in Italian both in pure form and Neapolitan patois and has some facility in French and Arabic. She is able only to speak English in the form of popular greetings and single English words like bread and milk. She has always spoken Italian in the family home and her parents were Italian, from Naples. She is a brilliant cook of Italian food and regularly attends mass at the Catholic Church. Both of P's parents hold Australian citizenship.

Who are P and his parents? When he first attended school without any English, was he considered a "migrant", a "New Australian" or an "ethnic" student? Was his education modified in any way because of his origins or was he treated in the same way as "Australian" students because of his birth in Australia? Both parents and son classify their "cultural values" resoundingly as Italian, yet his mother was described as Middle Eastern-Egyptian, perhaps conjuring up a person of Islamic tradition and culture.

This example illustrates the dilemmas which arise therefore in the identification of the students of "diverse ethnic origins" who are the basis of investigation in this thesis. In the following section terminologies selected for this thesis will be defined beginning with a discussion of one of the most commonly used, namely, "migrants".

### 3.2.1 "Migrants"

As shown in some detail in Chapter 2, the largest contributor to the ethnic diversity of students in Australia's classrooms has been the continuing immigration program initiated in the initial post-war years (1950s) and which continues to operate fifty years later. The descriptor most often applied to immigrant students is "migrant".

In one of the prefaces under the title *The Need for an Australian Dictionary* in The Macquarie Dictionary, first published in 1981, the following words describe a purpose for its existence:

The dictionary tries to do justice to the distinctiveness of Australian usage. The editors have spent most of their time on that central area of vocabulary from

which are drawn the common everyday words of formal, informal and colloquial communication among people in their everyday lives (Delbridge, A, 1981,7).

In this dictionary the meaning of the word "migrant" (*n*) is listed as one who migrates.

In the Australian Concise Oxford Dictionary 3<sup>rd</sup> edition, (Moore, 1997), a "migrant" is listed as:

A person who leaves his or her own country to take up permanent residence in another.

In the Cambridge International Dictionary of English, 1995, there is no listing of "migrant".

It may be, therefore, that "migrant" is a peculiarly Australian term. That it is and has been, over the period investigated in this research, widely used in both Australian colloquial and written contexts however, is indisputable. In this thesis it will appear in the titles of government instrumentalities such as "Child Migrant Education Services, Victorian Ministry of Education" and in some academic references, for example, the use of the term "Migrant English" (Clyne (1985) in MacGregor & Moore (1991), 142) in which varieties of Australian English were described. However, its most frequent use in this thesis was found in the colloquial English used in the interviews of practising teachers who used it with confidence and certainty. Their personal definitions, on closer inspection, (discussed in detail in Chapter 6) were hegemonic and bounded by significant cultural interpretations, such as the exclusion of "migrant" students from Great Britain and the inclusion of overseas born students who were being educated in Australian schools but whose intention was to return to their homeland for permanent residence.

It was decided therefore to use a more encompassing terminology namely, "ethnic minority" in discursive aspects of this thesis. While the sum total of all "ethnic minority" students constituted a majority in many of the classrooms involved in the reports of teachers questioned and interviewed later in this thesis, they remain a minority in relation to total population figures. The descriptor "minority" therefore applies to a subset of the total Australian population. Who then was the "ethnic majority"?

### 3.2.2 Ethnicity versus countries of origin

As can be seen by the single example cited at the beginning of section 3.2, *Place of Birth* data was used to define nationality, and the holding of "citizenship" but that this seemed to be at odds with the term "ethnicity". Ethnic origin is difficult to quantify and this difficulty is mirrored in the need to measure and to project population statistics by Census and Immigration authorities for the purposes of national planning.

Debate over ethnic composition has been an enduring common element in the four traditional immigrant receiving countries of Australia, Canada, New Zealand and the United States (Castles et al, 1998, 38).

One classification which continues to be debated is a measure of 'ethnic strength' used by Charles Price, Emeritus Professorial Fellow in Demography at the Australian National University. This measure uses data which include country of birth, parents' birthplaces, citizenship, language spoken at home, religious affiliation, intermarriage rates and other aspects to measures of ethnicity. He quantified 'ethnic strength' which he described as follows:

....which is derived by adding fractions of people, according to their ancestry, to estimate the relative strength of various ethnic groups in the population (Price in Castles et al, 1998, 40).

Price's table of 'ethnic strength' appears in Table 5:

**Table 5 – Price's estimates of 'ethnic strength' 1861-2025 (per cent)**

Ancestor origin	1861	1947	1988	2025
British/Irish	78.2	89.8	74.6	62.3
North and West European	4.7	5.7	7.3	5.8
South European	0.2	1.5	7.4	5.9
East European	0.2	0.6	3.9	3.6
West Asian and N. African	0.01	0.12	1.4	4.1
South Asian	0.2	0.1	0.6	2.2
East and Southeast Asian	2.9	0.3	2.6	13.3
American	0.0	0.01	0.04	0.04
African	0.02	0.02	0.12	0.07
Polynesian	0.04	0.07	0.40	0.91
Aboriginal and Torres Strait Is	13.4	0.8	1.0	1.6

Sources: Hugo 1994; Price, 1996, in Castles et al, 1998, 41

Price stressed that the results were estimations and that his definitions needed to be closely read. His classification of Lebanon and Turkey as West Asian rather than Middle Eastern, for example, raised the Asian figure. He maintained that 'ethnic strength' was the most reliable measure of ethnicity. While caution is advised by Castles et al in using its figures it clearly depicts "ethnic majority" over the period of this study and in a projection to the year 2025, as British/ Irish (Castles et al, 1998). This terminology is equivalent to another and more commonly used expression, namely Anglo-Celtic. It can be seen also, in Price's projection, that the ethnic majority which in 1988 constituted 74.8% of Australia's population has decreased steadily over the previous years and in 2025 will reach 62.3%. The latter figure is largely due to Price's projection of increased 'ethnic strength' in the West Asian and N. African, South Asian and East and Southeast Asian categories. The problem with this projection is that it assumed that current trends will continue when in fact any change in net level and composition of overseas migration in the next twenty-five years would lead to quite different results. Smolicz described Price as a demographer of major importance who has played a major role in the provision of extensive factual material which has been used widely in government reports and used by committees in recommending new policies. Price, he wrote:

....has introduced a demographic dimension to the discussion of educational problems that Australia has faced with the increasing range of diversity of ancestry, identification and culture among its student population (Smolicz, 1987, 320).

Price's measures of "ethnic strength" overcame, in a measurable way, the difficulty of finding an appropriate single terminology for distinguishing ethnicity. In this study Price's definition will not be used however, but it has influenced the choice of terminology by the researcher. In the researcher's personal experience students experienced little difficulty in classifying ethnicity. Price's South European group was distinguished in the school grounds from his Anglo/Celtic (British/Irish) group through the use of the words "wogs" and "skips", neither term appearing to cause major embarrassment. Both of these terms are now listed in the Macquarie Dictionary and are described as derogatory. Whether or not Price's projection of the future until 2025 is accurate, it is based on the premise of continuing immigration to

Australia which implies that ethnic diversity will still be a feature of Australia's population for the first twenty years of the twenty first century. Given the confusion inherent in the word "migrant", for the purpose of this thesis "ethnic majority students" will denote students who are of Anglo-Celtic background and the term 'ethnic minority' will be used to describe any student of a mathematics classroom who is not of Anglo-Celtic ethnic origin.

A final complication in classification of ethnic minority students emerged in the use by teachers of the terminology "generation". The categorizations of this term according to Castles et al were:

The 'first generation' refers to the immigrants themselves, the 'second generation' to their children born in Australia, the 'third generation' to the immigrants' Australian-born grandchildren, and so on (Castles et al, 1998, 37).

In fact, the researcher found in interviews conducted with practising mathematics teachers (Chapter 6) that in some cases no distinctions were made, so that the term 'migrant' was applied to students who belonged in fact to the 'third generation'.

The difficulty which Australian officialdom found in the use of terminology in relation to immigrant peoples may have its roots in Australian societal sensitivities. In the 1990's a significant number of the Australian population supported a movement for Australia to be declared a republic. In a Federal referendum held in the year 2000, the notion of Australia as a republic was defeated. This result however, has not dimmed the continued support by sections of the Australian public. According to Melliush (1998) a lack of self-confidence had the effect of conferring an "ascendancy of administration and law", causing a sameness to descend on Australian life with which the various break-away or pro-republican groups came into combat. It would seem that deep in the psyche of some members of the Australian population there is some form of denial of its subjection to an Anglo-Celtic heritage despite their roots in this heritage. The contradiction has some resonance with the descriptions in Chapter 2 of British-influenced Australian mathematics education which was seen as hierarchical, and as conferring a prevailing uniformity in its practice up until the 1980's. Conversely, at the same time, unlike Great Britain, an ambivalence has

prevailed among Australian mathematics educators and political advisors towards the production of their own National Mathematics Curriculum. Clements attributed this ambivalence in part to a fear of elitism in the following words:

Whatever may be the rhetoric, in school mathematics the concepts of 'national curriculum' and 'national assessment' do not sit easily with the notion of 'mathematics for all'.....

With school mathematics, 'national curriculum' and 'national assessment' almost inevitably imply 'failure for many' (Clements, 1989, 65).

Given the inclusions, in teacher perceptions, of up to three generations of migrant designation, it was found that further qualification was needed to define the term "ethnic minority" for the purpose of this thesis.

### 3.2.3 *Selected terminology in this thesis*

To put in place some parameters of definition, the general term "ethnic minority student" will be used as described above, but this will be qualified by the requirement that these students must be born overseas or must have at least one parent born overseas and must have attended an Australian school for at least one continuous year. The reason for the short time interval is the inclusion of ethnic minority students in this investigation who came as temporary residents to Australia for reasons such as work involving their parents in Australia. Such is the case for many Japanese students (usually for a period of four years). For other overseas students, their goal is gaining a school education in Australia. This is the case for many students of Chinese origin, often for the last years of secondary schooling.

There remains then, the problem of terminology used in government education reports and policy recommendations and in some immigration statistics which will appear in Chapter 4. The general stance of using ethnic minority and ethnic minority terminology will be taken by the researcher as described but will be qualified appropriately by reference to the measures used in the various reports. Similarly, in the direct transcriptions of teacher comments which will appear in Chapter 6, the term

"migrant" students will be retained; but in discussion and tabling of results, this terminology will be incorporated within the terms ethnic minority and ethnic majority as described above.

### 3.2.4 *Connections between ethnicity and culture*

The terminology "ethnic minority student" and "ethnic majority student" and the notion of ethnic diversity which is a prime mover of the research in this thesis, all form part of the collective entity "ethnicity". However the word "culture" is more frequently used in literature which groups various aspects of mathematics education under a collective title.

Chapter 2 described a movement in the last twenty years towards a different philosophy of mathematics education. The previously held philosophy, that mathematics education should be based on belief in a narrow purist and exclusivist character of mathematics, has been replaced by a the view that effective mathematics education must include aspects of the social and cultural environment of the learner (Ernest, 1991; Bishop, 1988). This change of philosophy has been the subject of a number of research papers. An appreciation of the extent to which it penetrated into the practice of mathematics teachers is one of the objectives of this thesis. In *Vinculum*, a publication of the Mathematics Association of Victoria (MAV), edited and read largely by practising classroom teachers, Thomas wrote:

Most of the readers will be aware that mathematics and social context is a major issue in mathematics education at the moment and was the focus of a special day at the sixth Annual conference on Mathematical Education in Hungary in 1988. It is also a very complex issue. At its heart is an understanding that mathematics taught at schools is the product of many cultures .....

Because mathematics is a cultural product it is neither culturally neutral nor value free (Thomas, 1989, 5).

"Culture" therefore needed to be included in the investigation particularly in relation to its connection with "ethnicity". Definitions of culture differ widely. Like "ethnicity", "culture" is a complex collective term. Earlier in this chapter 'ethnic strength', was described as a measure of ethnicity, still being debated, which was achieved by the addition of a number of fractional parts based on the contributions of



several attributes. In a less mathematical definition Yuval-Davis assembled a similar collection of attributes as follows:

Ethnicity ...is therefore primarily a political process which constructs the collectivity and its 'interest' not only as a result of the general positioning of the collectivity in relation to others in the society, but also as a result of the specific relations of those engaged in 'ethnic politics' with others within that collectivity (Yuval-Davis, 1997, 40).

She listed the involvement in ethnic politics of factors such as gender, class, political, religious and other differences. For the purposes of this thesis "ethnicity" will therefore be regarded as a subset of culture. One definition of culture is as follows:

..... 'a particular way of life, whether of people, a period or group' (Williams, 1983, in Yuval-Davis, 1997, 40)

Giddens expanded this to a definition sociologists tended to use. According to him:

this way of life is composed of 'the values the members of a given group hold, the norms they follow and the material goods they create' (Giddens 1989, in Yuval-Davis, 1997, 40).

Finally, two catchwords which appear in immigration and mathematical education documents are "assimilation" and "multiculturalism". Of these words it is the second, multiculturalism, which has passed into and continues to be used in most general descriptions of the Australian 'way of life'. The word assimilation has been applied in a more retrospective sense and applied to the first years of immigration into Australia when many of the effects of this massive alteration to the nature of Australia's population were not yet realized. The period of integration which followed evolved into multiculturalism.

### *3.2.5 Two public attitudes to post-war immigration in Australia*

The significance of post-war immigration to the magnitude of the Australian population has been discussed in Chapter 2. Jupp quantified the population numbers in the following terms – the proportion of overseas Australians born overseas in 1947 numbered less than 10%, the lowest proportion since settlement records were kept in 1828. In the 1996 census the percentage of Australians born overseas was 23%.

Moreover in the 1996 figure four times the proportion of Australians born overseas were born in countries other than the United Kingdom and Ireland. Jupp stated:

Perhaps most importantly there are now large populations derived from countries which, in 1947, had virtually no presence in Australia, such as Vietnam, the Philippines, Chile, Turkey, Sri Lanka, the Netherlands and Egypt (Jupp, 1998, 134).

What prevailing philosophies therefore underlay government policy over this period?

### 3.2.5.1 Assimilation

The aim of the immediate post-war immigration was firstly to accept permanent settlers mainly from Great Britain (England, Scotland, Wales and Ireland) and if they failed to arrive, to fill the gap with other Northern Europeans.

Castles et al wrote:

Australians have a long history of being worried about cultural diversity.....The first post-1995 immigration program was designed not to create a culturally diverse society, but to prevent it (Castles et al, 1998, 109).

Jupp echoes this statement as follows:

It was not the intention of the post-war planners that such variety would be created. Apart from their dedication to the idea of a White Australia, they were assimilationists.

and

Assimilationism meant the abandoning of all characteristics that made individuals visible in a crowd (Jupp, 1998, 134).

This view of assimilation negated every tenet of teaching and learning practice since the first school education systems began despite the advent of different styles of pedagogy through the ages. Castles et al described the impact of assimilation as follows:

Securing a good education for their children was one of the main aspirations of post-war immigrants. But the assimilation policies of the 1950s and 1960s meant that immigrant children were put into normal classrooms – often at a

level below their age – without any special help in learning English or adapting to the new environment (Castles et al, 1998, 99).

How the policy of assimilation, manifested itself in the environment of the mathematics classroom during the period of study will be discussed in detail in Chapters 6. Certainly assimilation was characterised by a deliberate policy of maintaining the existing environment of the classroom. For example no distinctions were made between English and non-English speakers in such activities as reading English language mathematics text books, often written and published in the United Kingdom. There were cultural traps in the wording of mathematics problems. In the writer's own experience of teaching secondary school mathematics there was an assumption that all students knew, without a written statement, that cricket teams fielded eleven players. Observations of ethnic minority students in the school learning experience of the writer, such as reluctance to participate in class discussion, the markedly different writing of numerals and their setting out, and different previous experiences of sequential mathematics content, appeared to evoke no response from the teacher.

In the arena of public life, assimilation, in fact, imposed a number of restrictions such as the necessity of using English in all public environments, the wearing of clothes indistinguishable from those worn in the general population and, the non-acceptance of unusual gestures. Advice to this effect was set down in official welcoming material (Jupp, 1998). However, as has been described in Chapter 2, official material addressed to immigrants from the United Kingdom virtually implied an instruction to "carry on as usual". Jupp stated:

Non-British immigrants were expected to abandon their alien ways and become Australian. No such demands were made upon British and New Zealanders (Jupp, 1998, 135).

In 1964 the Assimilation Branch of the Department of Immigration was renamed the Integration Branch as a response to a perceived impracticability of the assimilation policy and the social and educational disadvantage it imposed on immigrants. Other reasons could be attributed to this change, such as the high number of non-British migrants who were retaining their languages and cultures in ethnically distinct

communities segregated from the rest of the population (Castles 1998). In 1972 the newly elected national government under G. Whitlam, of the Labour Party, repudiated assimilation and, soon after, the then Minister of Immigration, A. Grassby, introduced the notion of the multiculturalism to describe the nature of Australia's population. Multiculturalism was a term which had been in use in Canada since about 1968. Castles et al wrote

The result was a shift to multiculturalism, which is based on the idea that ethnic communities are legitimate and consistent with Australian citizenship, as long as certain principles such as respect for basic institutions and democratic values are adhered to (Castles et al, 1998, 109).

### 3.2.5.2 Multiculturalism

In writing about the perceptions among the public of multiculturalism Jupp stated:

Despite attempts to define multiculturalism by advisors to government ..... the term remained rather vague until the 1978 report of the committee on migrant programs and services, chaired by Frank Galbally (Jupp, 1998, 138).

A more succinct definition which espoused the disadvantages suffered by immigrants was arrived at under the Liberal Government and its official usage continued unbroken until 1996 throughout the appointment of four prime-ministers in that time. The implementation of this policy after the Galbally Report included the recognition in government services, that many of the clients did not speak English; immigrant welfare needed to be delivered through subsidized ethnic organizations, for official support of community languages and media and for setting up a research institute to develop knowledge about Australian cultural variety. Between 1973 and 1980 official funds were expended on a variety of institutions and programs in the name of multiculturalism. In the early 1980's multiculturalism was seen to be concerned with social justice and equity rather than with the maintenance of community language and cultures. Official multiculturalism went through cutbacks and reinstatements in the late 1980's and early 1990's before 1996, after which the Howard Liberal-National Coalition government, whose attitude was described by Jupp as "much more ambivalent" (Jupp, 1998, 139), abolished the two major Commonwealth multicultural agencies, the Office of Multicultural Affairs and the Bureau of Immigration, Multicultural and Population research (BIMPR), although the states continued to

support ethnic and multicultural agencies. A more generalized approach was adopted in 1997 by the Commonwealth government through the establishment of The Human Rights and Equal Opportunity Commission replacing a specific race-relations focus. In this thesis multiculturalism will be used to describe those policies and implementations concerned with immigrant welfare up till 1996, documented to a large extent by publications of BIMPR. The effects of the next phase of government policy are too recent for inclusion. "Multiculturalism", however, continues to have a place in public usage.

The fact that the term "multiculturalism" was originally imported from Canada implied that Canada, like Australia, had to arrive at a workable designation for its ethnically mixed society, although the meaning and aspects of its implementation may have conferred on it a connotation different from Australia's. Castles et al have described immigration programs which bear similarity to that of Australia as follows:

In the international context, the countries with which Australia is most often compared in immigration matters are Canada, New Zealand and the United States. Immigration has had a similar defining role in these societies as in Australia, and the four countries together continue to receive the great majority of the world's permanent immigrants (Castles et al, 1998, 8).

In the next section international research and research within Australia into the connections of mathematics education with culture, and in particular with ethnicity, will be investigated.

### **3.3 Exploration of previous research**

Earlier in this chapter, it was seen that the imposition of an ethnic culture, namely an Anglo-Celtic culture, within the mathematics teaching and learning classrooms in Australia was a deliberate action and an inevitable outcome of the assimilation period of Australia's immigration policy which sought to retain the British heritage of mathematics already in place. Melliush asserted that Australia's close cultural ties to Great Britain in the immediate post-war period were already experiencing some fragmentation, abetted by an increasing awareness of the culture of the United States. However, mathematics in the Australian classroom in the immediate post-war period would have provided familiar education for the large number of British immigrants

arriving in Australia at this time. In Chapter 2 the work of writers such as Clements (1989) and Horwood (1997) described the continuation of substantial British influence in almost all aspects of mathematics education in the schools of Australia up until the 1960's. A number of writers and commentators (for example, Castles, 1998); Hugo, 1993; and Jupp, 1998) on immigration to Australia at this time have evidenced the general attachment of the Australian-born population to British ideals and have not recorded the changes in attitude described by Mellowish (1998) in the early post-war years. Ethnic majority attitudes certainly constituted an imposition, however, on the numerous and increasing numbers of immigrant students whose educational heritage was not of British origin.

What attention then had the affairs of ethnic minority students within mathematics education attracted in research?

### *3.3.1 Cultural and political connections in mathematics education*

It was not until the recognition of the connections between ethnicity, culture and mathematics begun by D'Ambrosio in 1985 and Bishop in 1988, that the role of ethnicity within mathematics education was recognised and researched. That countries needed to frame their mathematics education to their own cultures and ethnicities, became a focus in classroom mathematics. This focus extended also to different cultures and ethnicities within the boundaries of any one country.

The notion of Ethnomathematics was introduced in the publication of *Ethnomathematics and its place in the History and Pedagogy of Mathematics* (D'Ambrosio, 1985). A contemporary approach at the time introduced political dimensions in what Skovmose described as 'critical education' in a paper titled *Mathematical Education versus Critical Mathematics Education* (Skovmose, 1994). Mellin-Olsen in 1987 linked cultural and political factors in his book *The Politics of Mathematics Education* in the following words:

My aim is thus to argue that the different uses of mathematics in various cultures can be decisive as to whether the members of one culture learn the mathematics of a curriculum or not. Such a position implies that, as educationalists, we not only have to include the cultural aspects when

developing a curriculum, we also have to realize the impact of possible conflicts between the various cultures to which the pupils relate (Mellin-Olsen, 1987, 16).

In subsequent years the philosophy that connected culture with mathematics education gained momentum and a large number of writers from around the world contributed research papers and publications.

In 1988, Bishop edited *Mathematics Education in Culture* in a special issue of *Educational Studies in Mathematics* (Bishop, 1988). This was followed by his book *Mathematical Enculturation: A Cultural Perspective on Mathematics Education* (Bishop, 1988). In the same year at the sixth International Congress on Mathematical Education (ICME), a day set aside considered *Mathematics, Education and Society*. A substantial number of papers submitted in the program appeared in an UNESCO publication edited by Christine Keitel and organised by Peter Damerow, Alan Bishop and Paulus Gerdes. In his paper Lerman wrote:

...I suggest that teachers of mathematics can no longer sit in the school staffroom, believing that values enter every classroom except the mathematics one, and this not simply and solely because of arguments such as that education is everyone's responsibility. Since mathematics is as much a social construction as any other form of knowledge, it is culture-bound and value-laden (Lerman, 1988, 43).

Research into and practical implementation of mathematics education to meet the needs of its particular cultural configuration would seem then to be an obvious progression. The work of Bishop, and the contributions of other writers in Australia such as Clarkson, Clements, Crawford, Dawe, Ellerton, Leder, Siemon and Thomas indicated that Australia was well placed to investigate aspects of its own implementation of classroom mathematics as much of the original impetus for the recognition of the linkage between mathematics education and culture had emanated from Australian sources. Did this investigation occur and were there implementations

of response in Australia? In the conclusion of his paper in the UNESCO publication Australian contributor Dawe wrote:

The issue at stake for the developing nations of the South Pacific, however, is how to retain their distinctive identity while facing the pressures of economic, political and technological change. These countries have a wealth of ethnomathematics in their cultures which can contribute towards this goal. Countries like Australia and New Zealand can do much to encourage such development (Dawe, 1988, 11).

Australia however, had some significant hurdles to surmount which have made the task of implementation of mathematics education which responds to ethnic diversity, more complex than that of some other countries in the world.

### *3.3.2 The Australian research context*

Research and implementation of the ideals of ethnomathematics around the world have been applied to distinct cultural groups where mathematics has been imposed by other vastly different cultures. However within each distinct cultural group ethnicity has been common or closely related. In Australia the most striking example of such a distinct cultural group is its aboriginal population, who from the 1960s had pursued the ideal of establishing an identity (despite tribal loyalties and intermarriage) through which political influence could be achieved. By the 1970s multicultural ideas were beginning to develop. Jupp described the politically bipartisan responses addressed to aboriginality as follows:

Between 1973 and 1978 policy was mainly concerned with repudiating assimilation and with preventing racial or ethnic discrimination. In turning their backs on almost a century of discriminatory and assimilationist history, politicians might have taken a serious risk, had not both Whitlam and Fraser\* agreed that such a history had to be rejected in the interests of national harmony. The legislative and institutional changes included the racial and discrimination Act of 1975..... Aborigines were seen as likely targets of discrimination and became the most important ethnic group using the available protection (Jupp, 1998, 142).

(\*Both Whitlam and Fraser were Prime Ministers of Australia between 1973 and 1978) (Researcher's note)



Aborigines had dedicated their efforts to the establishment of their own identity under their own terms after years of banishment to a marginal existence in Australian society. After years of invisibility in the affairs of the nation they had consolidated their presence and an awareness of the injustice of their treatment in the past by European settlement on their land swept the nation. Did researchers in Australia respond to this painfully fought for self-determination by reshaping previously euro-centred aboriginal education? In particular, was a mathematics education, which related to their culture, attempted in the light of research which made a critical connection between culture and effective teaching and learning of mathematics?

### 3.3.2.1 Aboriginal mathematics education

In fact, in the 1980s, research and implementation of culturally-linked curricula was developed for the education of Australia's Aboriginal population as the following account of Pilakui revealed:

I am an Aboriginal teacher. I have taught in my own community, Nguiu on Bathurst Island, for many years. I taught children in early childhood and primary. In 1988 I did the D-BATE Program and this has helped me a lot, because its work was community based. This program has shaped into an aboriginal curriculum for Aboriginal concerns in education. I have been involved outside the school with a project with women and girls in some areas of reading and writing in Tiwi Language and Tiwi arts (Marita Alimajutuwu Pilakui, in National Aboriginal and Torres Strait Islander Pedagogy Project, 1991, 43).

This introduction to a description of her work was written by a teacher trained at Batchelor College, a teacher education college set up in 1986 outside Darwin in the Northern Territory under the auspices of Deakin University in Victoria after careful consultation with Aboriginal people living there. Her course, D-BATE, was the Deakin-Batchelor Aboriginal teacher Education Program.

In their description of difficulties encountered in putting ideas into practice in the curriculum of the Batchelor College, Henry and McTaggart wrote:

.... problems included the ways in which the logic accessible through English differed from the logic accessible through Aboriginal language.

The problem surfaces (from a Western perspective) in the practical task of Aboriginal language extension to make Western mathematics more accessible to Aboriginal first language speakers (Henry and McTaggart, 1991, 10).

Connell, describing another research initiative designed to improve participation of Aboriginal children in schooling in the 1980s, wrote:

Certainly, the most significant and widely supported point that was being made about education for Aborigines in the mid-80's was that of providing opportunity and encouragement for Aboriginal communities to participate substantially in the direction and determination of the education offered to school children and parents (Connell, 1993, 454)

and

The most powerful evidence of such participation came from an extensive research program, conducted by a unit of the Australian National University and published in 1983, on the nature of Aboriginality and the way in which children in school might acquire the life style and values of Aboriginal people.

It was the firm conclusion of the research team that 'Aboriginal communities should have the right to choose to have control over the schooling of their children: of the building, the school organisation, the curriculum and the choice of teachers' and that 'Material prepared for Aboriginal schools should be compatible with Aboriginal learning styles and respect the values and preferences of "Aboriginality"' (Connell, 1993, 456-7).

Implementations of culturally connected mathematics learning followed and these have been described by such writers as P. Harris (1991) in the Northern Territory who wrote *Mathematics in a Cultural Context: Aboriginal Perspectives on Space, Time and Money* in 1991. Other writers included Clarkson (1981); Graham (1988); J. Harris (1987); Hunting, (1987); and Watson (1987, 1988).

Did the same degree of research and implementation which related to Aboriginal mathematics education take place in relation to mathematics education within

classrooms, mostly urban, where, instead of one distinct but different ethnicity, as in the case of aboriginal education, many ethnicities comprised the whole student cohort? Were there impediments to the investigation of mathematics in classrooms where immigration had contributed enormous diversity to the origins of the student cohort?

### 3.3.2.2 The problem of ethnic diversity

It has been seen earlier in this chapter that Australia was not the only country to accept immigrants over the period of this study. But Australia has differed from other countries in its acceptance of immigrants since recognition of the relevance of culture to mathematics teaching and learning. In the United States the biggest group in the years of this study, and particularly over the period of recognition of the connection of culture to mathematics education, were students of Mexican and other Central and South American origins. Earlier, England had acquired a large West Indian and Pakistani population. In Canada large numbers of immigrants came from the Indian sub-continent. However, together with that of Israel, Australia's immigrant policy has attracted people with the most varied ethnic origins per capita in the world. Data in this thesis have been collected from mathematics classrooms where the ratio of ethnic minority students to ethnic majority students varied from less than 1 in 10 to greater than 9 in 10. In collecting this data (see Chapter 6) the researcher found one classroom with students from Poland, Somalia, Iraq, Iran and Tonga. This degree of diversity has presented Australia's researchers and mathematics educators with particular difficulties and challenges in constructing culturally-related mathematics education within its schools.

Although progress as a result of research is evident in Aboriginal education, little research could be found which was addressed specifically to responses in Australian mathematics education to the ethnic minority presence created by its immigration policies. The absence of this research is evident despite recognition of the concept of multiculturalism in Australia's population, which was coincident with the emergence of the importance of culture in mathematics education. At the same time the high degree of importance attributed by educators to classroom mathematics education has remained undiminished and its constituency within the curriculum has in fact increased as demonstrated in State and Federal government curricular statements.

(Documentation will be discussed more fully in Chapters 4 and 7.) Research and publications which have emerged have revolved largely around questions of language, for example, Clarkson, 1991; Clements, 1984; Clyne, 1985; Ellerton & Clarkson, 1996; Macgregor & Moore, 1991; and Thomas, 1986.

Clarkson asked the question about the need to address the diversity of ethnic origins in the following words:

Now there has been a shift to a recognition of the diversity of the population and to a hope that what is Australian can weld together the good things from all cultures represented in the land..... Within this great cultural diversity what happens in places of education? (Clarkson, 1991, 22).

The context of these comments was bilingualism and referred to the findings of such researchers as Dawe (1983) that, for ethnic minority students, competence in their own language was important for their success in mathematics reasoning. Australia's dilemma however, was how to address the multitude of languages present in many mathematics classrooms.

### 3.3.2.3 Mathematics for the disadvantaged

As the policy of assimilation of ethnic minorities moved toward integration and later to multiculturalism, new government initiatives were taken. Connell described the development of the Federal Schools commission in 1973 and its eventual settlement on six kinds of disadvantaged groups for which it was decided to provide assistance. These were listed by Connell as follows:

(i) intellectually and physically handicapped children; (ii) children with specific learning difficulties; (iii) schools in disadvantaged areas, particularly those in inner-city and rural areas; (iv) Aborigines and Torres Strait islanders; (v) women and girls; and (vi) migrants (Connell, 1993, 483).

There were obvious overlaps in this list. A hypothetical example could be a non-English Speaking (ii) Italian (vi) girl (v) attending school in Carlton in the 1970s (iii). (The details of the Child Migrant Education program and how it related to mathematics education will be given in Chapter 4.) The findings of federal inquiries into schools with high ethnic minority intakes in New South Wales and Victoria

*(Inquiry into Schools of High Migrant Density in New South Wales and Victoria in 1974)* had revealed a confused picture of needs – one of the most important being the disadvantage suffered by children who had an inadequate grasp of the English language. The common thread which ran through these measures was ethnic minority disadvantage. This thesis, however, began with an account which described firstly migrant superiority in the mathematics classroom and secondly the positive contribution made to the progress of a student (the researcher) of Anglo-Celtic ethnicity by the ethnic minority students present in her classroom. Connell, in reference to the 1970s, stated:

.....but, there was still a strong tendency to regard migrant students as being in the 'problem' or 'disadvantaged' category. There were many more trained and skilled teachers and there was a much greater supply of well-designed materials. There were still, however, too few skilled teachers for the size of the task and too few suitable teaching-learning materials (Connell, 1993, 463).

He exemplified cases where migrants had risen to places of importance in Australian society in the academic and creative arts. He stated:

By the early 1970s .....Chairs in several Australian universities were held by former non-English speaking students in a wide range of subjects in the humanities, and the social, physical, biological and applied sciences; migrant artists had greatly enriched the visual arts, music and ballet throughout Australia (Connell, 1993, 463).

Bullivant challenged the notion of ethnic minority disadvantage in the following words:

The models of the aspiration-motivation gradient and self-deprivation syndrome present an interpretation that challenges assumptions about ubiquitous ethnic disadvantage, which has influenced much of the thinking about pluralist education in English-speaking societies. Too many data in all of them are indicating that the conventional wisdom that students from NES and Asian backgrounds must be disadvantaged is no longer tenable and should be abandoned. The more the proportions of ethnic groups increase in English-speaking societies, the more will the reverse become obvious: many second-generation ethnic students are resisting forces of ethnocultural reproduction and are achieving better than their Anglo peers (Bullivant, 1987, 191).

Despite the dominant focus of educator response and the ongoing governmental legislation on a perception of disadvantage of ethnic minority students in education, the extent to which any responses from these entities related to perceived disadvantage or advantage of ethnic minority students in the mathematics classroom will be a major matter of investigation in this thesis.

#### 3.3.2.4 Sectoral bias in research

As will be discussed in more detail in Chapter 4, Government schooling has provided the arena for the collection of data for most research activities of education in Australia despite the increasing numbers of students who attend Independent and Catholic schools. However Catholic Schools, in particular Catholic Secondary schools, have absorbed large numbers of ethnic minority students over the period of this study. In 1981, according to Connell, two thirds of the population attended government schools, the other third attending Catholic Schools and Independent Schools.

Moreover, as ethnic minorities families have solidified their socio-economic status and have become more settled, they have moved their children in increasing numbers into the Independent school system. In some cases specific ethnic groups have created Independent schools of their own which have generally espoused educational values and religious beliefs predominant in their cultures. Examples of these schools in the state of Victoria include the Japanese School of Melbourne, St John's Greek Orthodox College and King Khalid Islamic College (Victorian Secondary Schools register, Ministry of Education, 1997). From the beginnings of schooling in colonial times, the private and public nature of Australia's school education has been preserved although the proportions of students in each sector have varied from state to state. In Victoria, while the government sector is largest there are significant numbers of students in both the Catholic and Independent Sectors. Government funding has been allocated to the latter sectors in varying amounts usually dependent on changes in political persuasions of governments over the period of this study. The impact of early migration on the Victorian Catholic sector in fact was so great that in 1955, a statement concerned with staffing of Catholic Schools, made by the Catholic

Archbishop of Melbourne, was reported under the heading: "Migration brings Crisis for Catholic Education" as follows:

"We have come to a stage when the Catholic system of education is in grave danger of breaking down.....With the sudden increase of population, mainly due to immigration." said His Grace, "a revolutionary change has come over this country in recent time" (*The Advocate*, 13 January 1995, reprinted in Rogan, 2000, 66).

The various stages of a "heroic" struggle to establish the Catholic Education Office, to build regional secondary schools, to initiate new institutions of Catholic teacher education and finally to establish the Australian Catholic University (ACU) in 1991 have been described in detail in Rogan's "A Short History of Catholic Education, Archdiocese of Melbourne, 1930-1980" (Rogan, 2000).

In investigating research contributions to the impact of ethnic minorities in classroom education, publications and occasional papers of two representative bodies of Independent schools in Victoria, namely Association of Independent schools of Victoria (AISV) and its affiliated body the Independent Association of Registered Teachers of Victoria (IARTV), no references were found to ethnic minority students and mathematics education in Australia. There were some publications which referred to international experience of multiculturalism in education. These publications included two occasional papers of the IARTV as follows: *Global and Multicultural Awareness: Education and the Valuing of Diversity* (Otero, G. 1998, No. 56) and *Global Nomads: Meeting the Needs of 'Third Culture Kids' in Schools* (Pollock, 2000, No. 68). Specific research into ethnic minority students in the mathematics classrooms from research facilities of all sectors in Victoria, either through major public universities and research bodies or through the agencies of Independent and Catholic schools, could not be found by the researcher. There has been, however, recognition of general disadvantage of sections of the student community in education. As a result, the affairs of ethnic minority students in Australia's schools have been linked with other areas of disadvantage in research and responses.

### 3.3.2.5 Researching ethnic participation

In Chapter 2 the concentration of ethnic majorities in inner suburban areas was discussed using quantitative data of the BIMPR. Within the urban areas, various cultures became predominant. For example, Italians congregated in the inner Melbourne suburb of Carlton in the immediate post-war period, and in 2000 there is still a concentration, although a smaller one, in this suburb. However, in this study no research findings were discovered which made recommendations for the participation of these immigrant groups in the choice of "buildings, school organisation and curriculum and choice of teachers" as in the research recommendations for Aboriginal education, described by Connell (1993). The treatment of Aboriginal education was a function of political directions at the time and had to do with reconciliation and a growing consciousness of the cruelty of past treatment of the aboriginal population. Clarkson exemplified research impediments when, in a comparison with a statewide school system in Australia, he described schools in the USA in the following words:

There is also an interesting contrast with the situation in Victoria (State of Australia) which throws light on how results of research studies cannot be exploited fully, because of the wider political situation in which a school system operates. In many school districts in these bilingual areas (in the USA), there are a number of external forces operating on teachers and schools which are absent from Victoria's schools. One is that the schools are far more accountable to school district supervisors. This includes the particular programs that are run within the school. Thus, in San Diego, for instance, there is apparently strong political pressure in some districts for virtually all teaching in the first few years to be in Spanish. This is certainly translated into the classroom situation.....

and

...although there is little effort to set up a bilingual environment for children in the early years of schooling, it is looked upon as a transitory stage. The aim of the school is to move the children into the dominant English culture, and this means learning in English from the middle of the primary years of schooling marked clearly by the Year 3 'test' (Clarkson, 1991, 25).

Thus, in Australia, as in the USA and other countries, there were predominant enclaves of ethnic minority students, particularly in urban areas. Was there research with resultant recommendations in the way that Aboriginal schooling was



investigated, to involve localities in shaping the environment of their schools? Were schools and their communities interested and/or able to access any sort of interaction with the neighbourhood structures of their target enrolments? In a table describing Victorian school administrative structure in 1985 (in Chapter 4 of this thesis), the Education Ministry chain of responsibility ended with the School and School Council. In School Councils in Victoria there was public and parental representation, but links with internal or external research avenues were not depicted.

### 3.3.2.6 Australian mathematics education research

Which areas of Australian research were related to mathematics curriculum during the period of this study? What research directions and implementations may have provided major competition for a study of responses to the ethnic diversity caused by immigration? Aboriginality did elicit response from mathematics researchers and educators, but its place in the national psyche was a unique and emotive domain built on a sense of collective national guilt which had no parallel with the affairs of the ethnic minority.

The Mathematics Education Research Group of Australasia (MERGA), which began in 1977, is a representative group of mathematics researchers in Australia and countries of the south-western Pacific rim. MERGA has published summaries and commentaries of research in mathematics education in Australia dating from its inception in 1977. Australian research activities in mathematics education appears in Table 6.

**Table 6 – MERGA research directions**

CATEGORIES	1977-1979	1980-1983
1. Curriculum	29	26
2. Attitudes to mathematics and the Learning and Teaching of Mathematics	10	6
3. Problem – solving	8	1
4. Studies on Learning and Cognitive Development	22	42
5. Calculators and Computers	5	1
6. Other	5	1
	79	77

This table is an adaptation of a table summarizing MERGA research in mathematics education in Australia: 1977-1983 (Jones, 1984, 6)

It can be seen that two categories of MERGA mathematics education research in the period 1977-1983 were major priorities, namely Curriculum and Studies of Learning and Cognitive Development. Within the Curriculum category, Curriculum development and Curriculum Research occupied most researchers. However the field of Studies on Learning and Cognitive Development was by far the most prolific which:

.....reflected the interest that has been generated by relating Piaget's stage theory of cognitive development to the development of short term memory capacity, by describing tasks at different stages in terms of the number of elements that have to be processed simultaneously. Clearly the work of Collis and Halford in this country has stimulated and maintained a strong interest in mathematics education research of this kind (Jones, 1984, 14).

Within this category, the work of Hunting and Whitely (1983) concerned the mathematics achievement of Aboriginal students which included cross-cultural studies within culture studies. This work contained a review of the term ethnomathematics and its significance.

In the context of language connections with student achievement in mathematics, groups of ESB and NESB students were tested (Turner, 1980). Blane, in his listing of research in the geographical area covered by MERGA, had a category with the title *Sex and Ethnic Differences*. However the majority of research papers in this category were directed to gender; the others concerned Aboriginal and Pacific Island mathematics education.

Thus between 1973 and 1983 there is little evidence of ethnomathematics and no research directed towards the mathematics teaching and learning of immigrant ethnic minority students. In the four-yearly summary, *Mathematics Education in Australasia: A Selection of Recent Research* (Blane and Leder, 1988), three areas of Australian research were described, each of which represented strong research directions. These were Psychology and Mathematics, Problem Solving and Gender and Mathematics. Annotated bibliographies of these three areas of research were presented. Of the 378 articles covered in these chapters, over 200 concerned Problem Solving (Watson & Atweh, 1992). A further summary, *Research in Mathematics*

*education 1988-1991*, comprised three parts, each containing four chapters, which presented an overview of research areas under the headings: *Part 1 Mathematics Education in a Wider Context*; *Part 2 Issues in learning and Instruction*; and *Part 3 Specific Topics in Mathematics Learning* (Atweh & Watson, 1992). In Chapters 1 and 2, Australian research relevant to this study was included under the titles *Politics of Mathematical Education in Australia* (Thomas, 1992) and *The Social and Cultural Context of Mathematics Education* (Atweh, Cooper & Kanes, 1992). In reference to the identification of two dimensions of politics of mathematics education, Thomas wrote:

One is concerned with social context and the factors that assist or prevent people from participating in mathematics. These include language, culture, gender and socioeconomic status. It is an established area of research in Australia and is important for effective political action in regard to the other dimension of the politics of mathematics education. This is concerned with government policies and practices and is the focus of this chapter (Thomas, 1989a, in Atweh & Watson, 1992, 26).

Atweh, Cooper and Kanes (1992) described social context as a growing area of mathematical research in Australia. Under the section titles *Focus on Culture and Language* in this chapter, however, most of the research is directed to the mathematics education of aboriginal peoples. The work of Watson and Crawford in their assignation of mathematics education to a connection with social context and language (Watson, 1989a), and relationships between low achievement in mathematics (Crawford, 1990) and non-technological cultures were indirectly related to this study as were studies of bilingual student achievement in mathematics (Butler & Marsh, 1986). Social background studies were fairly extensive but were not applied to ethnic minority students with immigrant backgrounds despite focusses on family, community, social class and gender.

Finally in *Research in Mathematics Education in Australasia 1992-1995* (Atweh, Owens & Sullivan, 1996) the conclusion of the section *Social and Cultural Contexts in Mathematics* included the statement:

Over the past four years since the previous review of research, it is noteworthy that there have been noticeable trends in the research in this area (Zevenbergen et al, 1996, 31).

Concern was expressed at the lack of research in aboriginal mathematics education which, while described as "constant", was also felt to be "minimal" and "marginal". However, a chapter was devoted to the field of Ethnomathematics which was described as a research area which has grown both in Australasian and in international contexts. In this chapter a substantial number of areas of research in ethnomathematics were referred to, none of which involved the mathematics education of immigrant ethnic minority students in Australia, but which included aspects of cultural connections with mathematics education of industrial and non-industrial cultures. The following words of Bishop were cited:

Each cultural group generates its own language, religious beliefs, etc, so it seems that each cultural group is capable of generating its own mathematics (Bishop, 1988, 180).

The work of Begg (1995a) who compared the mathematics curricular of five industrial European countries was described as follows:

Although culture was often mentioned in making connections, he (Begg) found that in all of the societies there was no evidence of contributions from people other than mathematicians, statisticians, or teachers and there were no situations in which students' backgrounds were considered (Peard, 1996, 46).

Despite this reported lack of response to student backgrounds, reference was made both to the newness of ethnomathematics research and to the growing body of knowledge relating to the social and cultural aspects of mathematics education.

However, ethnomathematics remained largely an academic area according to Peard who wrote:

The challenge to mathematics educators presented by the research of ethnomathematics is to make these findings known to curriculum developers and teachers so that ultimately more students will be able to link their personal worlds with the school mathematics they are expected to learn (Peard, 1996, 41).

### **3.4 The Australian silence – a summary**

Thus, research in ethnomathematics and cultural connections with mathematics education did not appear in Australian research outside the Aboriginal context until the middle 1990's at which time it was described as a growing area. When it did emerge in research papers it had not proceeded to any connection with governmental or macro policy and implementation. In the intervening years other areas of research had predominated. In Chapter 2 it was established that the long-standing influence of British influence was only challenged by an independent movement of Australian mathematics education in the 1980s (Clements, 1989; Horwood, 1997). Was this change of direction too recent for both researchers in mathematics education and the government to react to the international diversity of its immigrant population and possibly risk a relinquishing of its recently acquired Australian character in mathematics education?

Some particular difficulties to the stimulation of response to the newly created ethnically diverse mathematics classrooms, created by waves of post-war immigration, could be attributed to a peculiar Australian difficulty which lay in the recognition of the enormity, diversity and nature of immigration. When Australia did recognize the existence of its immigrant peoples the terminologies which were used in official documents to identify and describe immigrant students as a collectivity were as diverse as the ethnic origins of the students themselves. In Chapter 3 it has been shown that even the numerical bases of census population figures differed from one period to another and these differences were compounded by the question of who was Aboriginal and into what category Aborigines should be placed. The fact that Aborigines did not appear in the census at all until the mid 1960s is one of the most sensitive issues in the aboriginal history of *Modern Australia*.

But there were other impediments to research progress. Among these difficulties was the general perception of undifferentiated disadvantage in of all immigrant peoples. Certainly they were troubled peoples, many of whom came to Australia under the umbrella of refugee status and humanitarian reasons. Immigrants were not necessarily educationally disadvantaged in all areas however, and one of the objectives of this thesis is to consider the validity of their designation as disadvantaged students in mathematics education. (This will be treated in detail in Chapter 6.)

During the period of study, relevant reform in the attitudes of researchers to mathematics educators around the world was taking place. Australian research played an important part in this reform which espoused the tenet that achievement of a good understanding in mathematics was effected if connections between the cultural values of its students and their teachers could be established in the classroom. The impetus gained by Australian-based research publications which were in the forefront of this international movement was certainly put to use in the mathematics education of indigenous peoples – perhaps because of an underlying atmosphere of political expediency. The researcher, however, had difficulty in finding connections between these research findings and the mathematics education of a substantial ethnic minority in Australia's population who brought values with them in mathematics education from all parts of the world. There was an extraordinary silence in research into the values that immigrant students brought with them, which were reflected in such things as their attitudes to the status of mathematics, their application and their skills.

A confused picture of the treatment of immigrant peoples in Australia has emerged. Societal and economic problems in the 1980s caused the government of the day to change its attitude from a policy of Assimilation, through a short period of Integration to a policy of Multiculturalism which remained in place through four successive governments until the late 1990s. Multiculturalism, which had some resonance with research findings that linked culture with mathematics learning, created significant change in several aspects of Australian life, which have generally been regarded as positive by the Australian public. What were the responses of mathematics educators under the combined pressures of continuing diverse immigration to Australia, a

generally positive attitude to immigrant contributions to the Australian way of life, and the findings of mathematics educators of researchers which linked quality of mathematics learning with cultural factors?

### **3.5 Research directions in this thesis**

A major stimulus for the use of the classroom as a forum for investigation lay in the practical and research experiences of the researcher

- as a mathematics student in a government country school which was attended by ethnic minority students from a nearby holding camp,
- as a secondary mathematics teacher in the state of Victoria for twenty years with teaching experience
- as a secondary mathematics teacher in the three sectors of school education, namely, Government, Catholic and Independent schools
- as a secondary mathematics teacher in an inner city school located in a high density ethnic minority suburb, in a suburban school with some ethnic minority students and in a suburban school with a significant number of overseas students who attended the school for variable lengths of time and whose intentions were to return to their home countries after the completion of their education years.
- as a Masters student who spent five weeks in Jogjakarta learning about the culture of Indonesia and observing secondary mathematics classrooms in action and whose Masters project was a comparative study of the mathematics curriculum in action in an Australian school with that of a Japanese school operating in Melbourne which used the National Mathematics Curriculum of Japan (Wotley, 1997).

What features of the classroom, therefore, led the researcher to select the mathematics classroom as a forum for investigation?

#### **3.5.1 Within the context of the classroom**

Two aspects of mathematics education had maintained a constant presence throughout the period. The position of mathematics as a compulsory core subject at most year levels, not linked with or shared by other subjects within the curriculum structures of Australia's schools, had been retained over the period 1950-2000. Also,

despite changes in pedagogical philosophy and practice, the responsibility for the implementation of the teaching and learning of mathematics in schools over the same period was invested in the teacher. The continuation of the classroom structure in schools through the whole period of investigation meant that useful connections could be made between the nature of different immigrant periods, the effects of different mathematical philosophies and the implementations of bureaucratic policies, at the exact point of provision of teaching and learning in practice.

In the search for response to ethnic minority students within the context of the classroom then, the following areas were investigated as follows:

- the environment and instructional process of the school
- the mathematics curriculum
- its resources
- mathematics pedagogy
- assessment procedures.

In Chapter 4 significant mathematics educators will be identified and a framework for investigating their responses to be ethnically diverse mathematics classroom will be described.



## Chapter 4

### *Intentions and implementations in the mathematics education of ethnic minority students*

While post-war immigration policy in Australia varied at different times over the last fifty years of the twentieth century, the overall effect of its implementation was significant change in many of Australia's structures of social and economic organization. Immigration throughout Australia's history had always been a significant determinant of the dimensions of Australia's way of life from its first beginnings as a colony. Castles et al wrote:

The continuing arrival of new settlers has been a dominant theme in the country's (Australia's) history and national development since 1788, and the overwhelming majority of its current inhabitants are either immigrants or descendants of immigrants arriving in the past two centuries. The influence of these successive flows of newcomers – initially from the British Isles, but more recently from all parts of the world – effectively defines every aspect of Australian life (Castles et al, 1998, 1).

In what ways did immigration policy define education as a part of "Australian life", described by Castles et al (1998). How was post-war immigration reflected in Australia's post-war classrooms and, in particular, in its mathematics classroom? Through what avenues could educator responses to immigration be made? In a description of the place of education in society the Victorian Government described the special role of education as constituting "direct and sustained involvement by government in the lives of all its citizens" (State Board of Education, 1988).

In this thesis, investigative research will be directed to two aspects of the mathematics education of ethnic minority students in the classroom. Firstly, what sort of connections with Federal Government immigration policy were encapsulated in the policies and management strategies of the Federal and State Government educational authorities, in the field of classroom mathematics education of ethnic minority students? The collective term used to describe the bureaucratic authorities and institutions of government in this thesis will be "macro", which will describe both immigration and education authorities.

Secondly, in what ways were strategies implemented by Victorian mathematics teachers in response to the presence of ethnic minority students at the point of delivery of mathematics education in their classrooms?

The researcher, in this thesis, will concentrate on the mathematics education of ethnic minority students. The terminology "ethnic minority" will be used in accordance with the definition established in Chapter 3, to describe those students in the period of investigation who are not of Anglo/Celtic ethnic origin and who were born overseas or who had at least one parent born overseas. These students were enrolled in an Australian school for at least one continuous year.

#### **4.1 Ethnic minority students in the mathematics classroom**

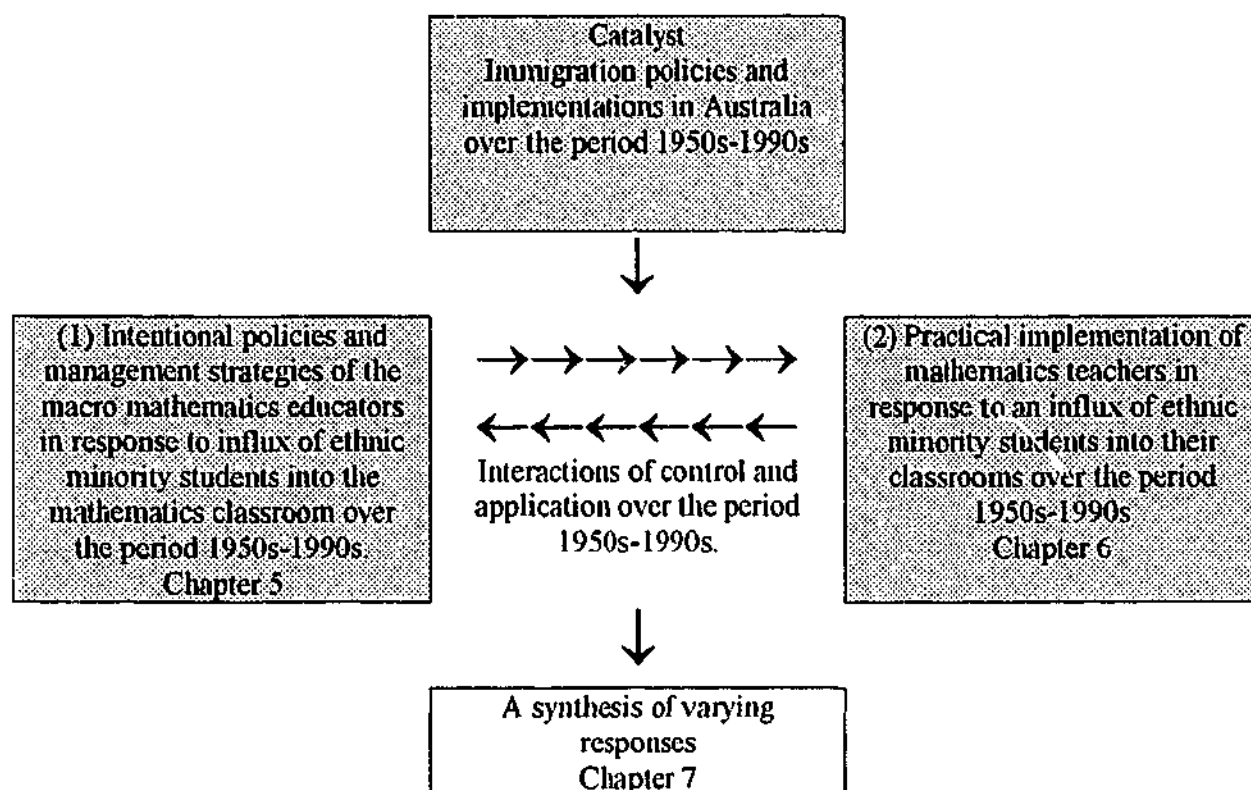
An investigation of responses of mathematics educators to the influx of immigrant students will be classified using two of the descriptive terms of Robitaille, namely intention and implementation as follows (Robitaille & Dirks, 1982):

- (1) Intention will be interpreted as the intentional policy and resultant management responses of the macro educators to ethnic minority students in the mathematics classroom and will be investigated through the use of documents and commentaries.
- (2) Implementation will be interpreted as the practical responses of teachers within their schools and mathematics classrooms and will be investigated through a survey of teacher perceptions of response in the mathematics classrooms to the presence of ethnic minority students within them.

#### **4.2 The tension between mathematics educator responses**

To gauge the response of Australia's mathematics educators the nexus between what was intended and what was implemented will be investigated. Diagrammatically this can be illustrated as a dynamic interaction between responses in the context of the twin pressures of the intentional policies and management of the macro educators in conjunction with Immigration Department policy on one side and the implementation of teachers in their mathematics classrooms on the other.

**Table 7 – Policy and practice – a dynamic interaction**



As can be seen in the preceding table the next two chapters of this thesis, Chapter 5 and 6 will include accounts of the policy and practice of mathematics classroom education in the Australian mathematics classroom. Positive and negative correlation and directional shifts in importance from one side of the interaction to the other will be considered in Chapter 7.

### **4.3 “Macro” change and the mathematics classroom**

How then did the government and sector authorities that controlled and regulated Australian school education react to the changing directions of immigration policy and in particular, to its evolving diversity? As was discussed in Chapter 3, this diversity may have contributed to the confinement of most of the research into the connections between culture and mathematics education to Australia’s indigenous student population with the exception of language based research. Certainly, as will be seen later in this chapter, there seemed to be some element of the unexpected in the emergence of immigration policies. Diversity was not the original aim of Australia’s immigration policy. It was provoked in the first instance by the failure of the first post-war immigration of Northern European (mainly British) peoples to reach a target of 1% population increase per annum and the necessity to look elsewhere for

immigrants (Jupp, 1998). What sympathy existed between policies and management of mathematics education and the policies and management of Australia's immigration program? Through what pathways of policy and management did the Australia's educators reach the mathematics classroom in the fifty-year period of this investigation? How did the work of the controlling bureaucratic authorities and institutions of government, described henceforth in this thesis, by the adjective "macro", respond to the influx of diverse immigrant students into the classrooms of Australia? Over the years what changes in mathematics classroom education were achieved which represented a direct response of macro policy and management agencies to the arrival of large numbers of ethnic minority students?

#### *4.3.1 Identifying the macro educators*

The terminology macro, will be used therefore in this thesis to describe the authorities and their work in fulfilling their responsibility for education policy and management at government level. The policies and directives of the Offices or Ministries of Education in both Federal (also referred to variously as Commonwealth or National) and State contexts were responsible for the shaping of Australia's school education. Horwood described the mechanism of response of government in the following words:

There are always two aspects to a response by government to any item of social concern – a policy response and an administrative response. The policy response has to be formulated by the government as a deliberate consideration of the issues involved, and it then becomes the responsibility of the bureaucracy to manage the implementation (Horwood, 1997, 181).

In turn, the policies of government were managed by a federal public service and by public service departments in each state referred to, at the time of the first post-war immigration, as the Office (Federal) and Departments (States) of Education. Where state activities are described in this thesis, Victoria (as referred to in Chapter 3) will be used as a representative state. In this chapter it will be seen that, while the proportions of Federal to State involvement in school education and the magnitude of their bureaucracies varied over the fifty year period of this investigation, these macro educators provided resources to schools, commissioned reports and research projects and employed a variety of agencies to formulate curriculum and assessment.

Another macro authority, namely the Immigration Department, a Federal Government institution, became involved also in education beginning its activities in the late 1940s and early 1950s during the first post-war waves of immigration. Morley and White described its connection with education in these years as follows:

....the first shipload of displaced persons, mostly Baltic people, arrived in November 1947. Immediately the Immigration Department organised classes where the newcomers could learn English at migrant centres such as Bonegilla, Sale, Rushworth, Somers and Mildura (Morley & White, 1973, 1114).

and

In December 1951 the (Victorian Education) Department, because of an agreement between the Commonwealth and State Governments, took over the responsibility of organizing and supervising migrant education in Victoria. This consisted, chiefly, of teaching the newcomers to speak English. The Commonwealth agreed to pay the cost. A close liaison has always existed between the Commonwealth Immigration Department, The Commonwealth Office of Education (now Education and Science) and the Victorian Education Department. Conferences between these three have been held biennially in Sydney or in Canberra for the mutual benefit of all three (Morley & White, 1973, 1115).

Connell described the relation between Commonwealth and State Governments in the following terms:

Australian education had always been subject to the political influence of State politicians. From the time when the Federal Government, in the 1950s, began to take a substantial interest in tertiary education and, in the 1960s, in aspects of secondary education, the influence of Federal politicians was also substantially felt (Connell, 1993, 5).

As the Commonwealth Government became more involved in school education, its educational structure changed and eventually the Federal Office of Education became a Department of Education headed by a Minister.

#### *4.3.2 Federal and State Government education policy*

By 1960, although the Federal government was involved in a number of fields of education, none of these was large enough to establish a bureaucratic education department. Education was one of the provinces of State government and in each state bureaucratic systems existed for the service of education. Education was not a field designated by the Federal Constitution. However the Federal Government was involved in a wide variety of fields where elements of education were required. Immigration was one of these fields of activity which also included such areas as armed forces training, external and internal territory development and international relations. To address these needs the Commonwealth Office of Education was set up in 1945 to provide educational advice and to liaise with the education authorities of the states (Connell, 1993, 237). The Federal Government was also involved in educational research. In 1949 the Commonwealth Scientific and Industrial Research Organisation (CSIRO) became involved in the teaching and training of research students in co-operative research with university staff. Background research for Federal policies was also conducted which included Australia-wide surveys of various aspects of Australian education in response to overseas requests. Studies of language teaching to migrant students were included in these projects. Connell described these Commonwealth Government activities as follows:

The Commonwealth Office of Education was responsible for developing important techniques in the teaching of English as a second language (ESL) in classes for non-English-speaking migrants and sponsored students from overseas (Connell, 1993, 238).

In addition the Federal Government provided an annual grant for the support of ACER (Australian Council for Educational Research) which undertook a number of research projects on behalf of the Federal government over the period of this study.

##### *4.3.2.1 The increasing role of Federal Government in education*

An illustration of the increase of Federal Government involvement in school education can be seen in Table 8 in the extract from a tabled summary of Federal education initiatives between 1964 and 1977 (Connell, 1993, 242).

**Table 8 – Federal Government participation in education 1959-1977**

1964	<i>Secondary school science laboratories program Commonwealth secondary and technical college scholarships Building and equipment grants to technical colleges Report of Martin Committee, "Tertiary Education in Australia" Appointment of a Federal Minister with responsibility for Federal activities in education</i>
1966	<i>Commonwealth Department of Education and Science established</i>
1967	<i>Capital grants made to teachers' colleges</i>
1968	<i>Schools' library grants introduced Funding to the states for Aboriginal advancement</i>
1969	<i>Recurrent grants to non-government schools for general purposes Program for child migrants introduced Aboriginal Study Grants Scheme introduced for tertiary education</i>
1970	<i>Establishment of Australian Advisory Committee on Research and Development Education (AACRDE) The first of three national curriculum committees appointed Aboriginal Secondary Grants scheme introduced</i>
1971	<i>Capital grants to government schools</i>
1972	<i>Establishment of the Commonwealth Teaching Service</i>
1973	<i>Report of the interim committee for the Australian Schools Commission, "Schools in Australia" Establishment of the Australian Schools Commission Aboriginal mission schools in the Northern Territory totally financed Recurrent grants made to teachers' colleges, technical colleges and pre-school education.</i>
1974	<i>ACT schools established</i>
1975	<i>Curriculum Development Centre (CDC) established</i>

The role of the federal government will be discussed more fully in separate treatments of major issues in the mathematics education of immigrant students in each decade later in Chapter 5. It is interesting to note that, within the above illustration of Federal government portfolio of activities, the affairs of "migrant" students did not occupy a very large space over the span of years between 1964 and 1975.

This lack of involvement with the affairs of immigrant students was in contrast to the attention directed to Aboriginal students in 1968, 1969, 1970 and 1973. An understanding of and sensitivity to the inhumane treatment by white settlers and their descendants of the indigenous people of Australia had reached the attention of the

world and of the Australian public. Political expediency, and the need to respond in a positive way, contributed to the increased attention of the macro educators to the needs of Aboriginal education. Despite the heavy involvement of the Federal Government in Aboriginal education the management of change by its public service was not always in sympathy with policy. Fesl in 1993 noted that while the "self-determination" of Aboriginal affairs began to be prominent in the attention given to their education, the same bureaucrats who were part of research teams to engineer change had worked through the preceding assimilationist period and were thus still implementing policy in the offices of management of the Federal government. The use of assimilationist bureaucrats, she contended, led to unworkability in the implementation of some educational policies such as the introduction of bilingual schools. Fesl wrote:

Unfortunately, in the government's haste to bring about changes in policy, insufficient cognisance was taken of the fact that the same old bureaucrats who had supported protection, then assimilation, were firmly entrenched and would be required to implement the new policy. Was it fair or feasible to expect them, after decades of indoctrination, to make the philosophical-psychological jump across the chasm from regarding Koories as dependants in need of their control, to independent individuals who could decide their own destiny (Fesl, 1993, 128-129).

This raises the question of whether the management and implementation of government policy was always in tune with the main thrust of the policy. Fesl also noted a connection between the impact of ethnic minority immigrant populations and the formulation of government policy in relation to aboriginal education. She attributed some of the changes in thinking of the macro educators in relation to Aboriginal education to the creation of the post-war immigration program. She wrote as follows:

Hundreds of people (known as Yurri Gurri or 'welcome migrants') entered Australia and dared to speak languages other than English in public..... often being abused because they were not speaking English ..... (Fesl, 1993, 128).

However, if the intentional policies of the Federal government in relation to Aborigines were not understood or applied by the Federal public service, then in the

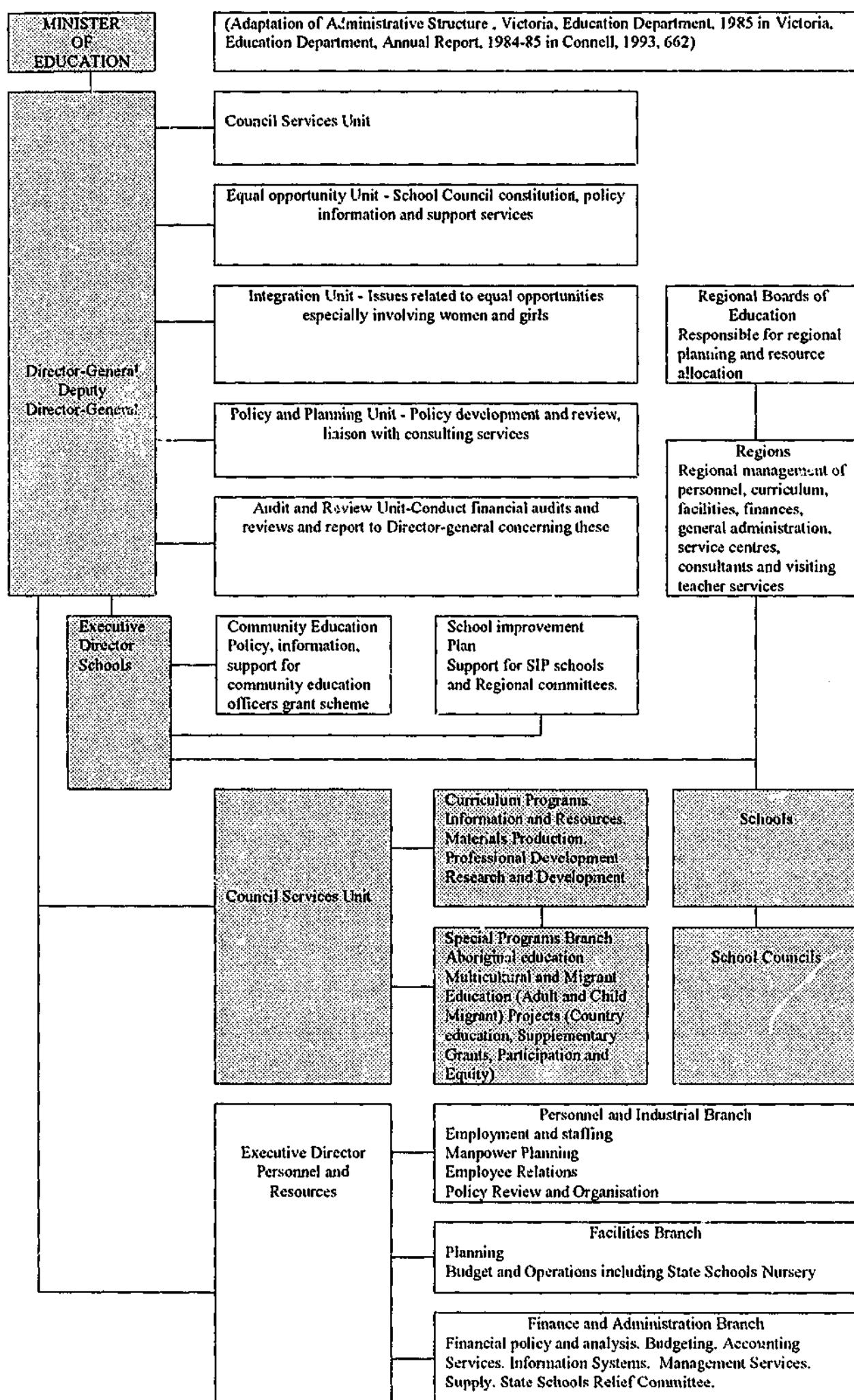


case of ethnic students, lack of Federal involvement with ethnic minority students may not have been a disadvantage.

#### 4.3.2.2 The involvement of State Government

State governments were also involved in the implementation of policy. Horwood, described the role of each State Education Department and, in particular, the role of the Victorian State Education Department as one which involved interpretation and some policy but one which was mainly involved with management and administration (Horwood, 1997). The Victorian Education Department administrative structure of 1984-85 appears in Table 9, adapted from Connell (1993).

**Table 9 – Victorian education administration 1985**



While within this structure there were diverse managerial sections over the years 1984-85 which were largely under the control of the Executive Director of Schools, policy formed part of the section controlled by the Director General and Deputy Director General. The Minister of Education, through a variety of pathways played a controlling role over all aspects of school education in Victoria. The Council and Services Unit, as part of the policy-making pathways, contained both the Curriculum branch and the Special Programs Branch. Within the Special Programs Branch, Multicultural Education Adult Migrant and Child Migrant education appeared as one of the sections. If the lines of communication are followed through to the end of the structural diagram it can be seen that School councils and Schools were the final destinations of the executive pathways of Victorian Education Department authority. The implementation of policy in the years illustrated therefore was addressed to the school leadership structures of government schools. The delivery point in the diagram of all educational services to individual students contained within Schools was therefore the responsibility of individual schools and not that of the individual teacher.

The implication of placing the management of government policy in the hands of the education departments of each State could have been a highly diversified structural approach to school education throughout Australia. In fact, there was remarkable similarity between States in their management of school education despite considerable resistance on the part of Australian mathematics education practitioners to the notion of a National Curriculum of Mathematics (Clements, 1989).

#### **4.4 Sector controls**

The Government school sector, through the period of this investigation, had been responsible for the school education of most Australian students. Two other school sectors had also played a significant part in Australian education; namely the Catholic school sector and the Independent school sector. Many of the first European immigrants who arrived in Australia in the first two post-war decades were Catholics and their need for a Catholic education created enormous demands on the existing Catholic schools in Australia, whose clientele at the time were mainly descendants of Irish settlers of the nineteenth century. In 1960 Catholic school student numbers constituted about 82% of the total non-government schools sector which itself

educated about 24% of Australia's school population. 18% of the non-Government sector were educated in the Independent or Corporate schools (Connell, 1993). In the first decades of post-war immigration these schools were relatively uninvolved with the education of the ethnic minority, one reason being the cost of the education they provided. In later decades, however, they became increasingly the destination of the offspring of successful ethnic minority parents. Thus all three schools sectors in Victoria were involved in the education of ethnic minority students although to different extents in different decades. In researching the responses to the presence of ethnic minority students through both the intentional policies of the macro educators and the practical implementation of mathematics teachers all three sectors will be represented.

#### **4.5 Within the classroom**

In the table of hierarchical levels of control of the macro educators of Victorian Ministry of Education of 1984-95, adapted from Connell (1993) and shown earlier in this chapter, the spectrum began with the Minister of Education and ended with the Schools and School Councils. To what extent were the responses of mathematics teachers to the ethnic minority students in their classrooms teachers bound by the directives of these levels of control? What intentional policies and management responses were enacted and utilised by teachers in the classroom? To what extent were responses the result of individual creativity and autonomous action on the part of the teachers? Through what investigative process could these questions be addressed?

##### *4.5.1 A preliminary exploration*

In pursuing the hypothesis that Australia's educators in mathematics education responded to the presence of ethnic minority students in their classrooms the researcher investigated the availability of individual comment on the practice of teaching and learning in the mathematics classroom. To distinguish classroom practice from the documentary evidence of macro educator response two sources of information were available, namely the students and the teachers. A preliminary exercise of obtaining responses from ethnic minority students and ex-students was explored. However, because the survey involved students over a period of almost fifty years, to arrive at the logistics of circulation of material to students no longer at

school, was a difficult task. Also action on the basis of response within the classroom was not within the control of students. Rather, this control rested with their parents and families. In any interchange of information with family groups and parents, language was likely to be a problem. Smolicz and Secombe (1985) investigated the attitudes and reactions of Polish ethnic minority students through the technique of using their memoirs 'in the two worlds of home and school, in their own eyes'. They described their research in an essay as follows:

It (the essay) is based on a humanistic sociological analysis of memoirs collected in the course of a competition that was organised in 1974-5 for Polish immigrants and their children in Australia. The competition itself, as well as the subsequent analysis of memoirs, was made possible by a research grant from the Education Research and Development Committee (Smolicz & Secombe, 1985, 119).

This methodology was based on the work of Znaniecki (1963) who used the memoir technique to tap the social and cultural situations of individuals through the expression of their own 'thoughts, feelings, aspirations and assessments' Smolicz and Secombe (1985) contended that large-scale surveys and questionnaire studies provided a limited opportunity to obtain data, while participant observation and in-depth interviews provided a better source, citing the work of Zubrzycki (1964), Martin (1965, 1972), Bullivant (1979) and Bottomley (1979).

Language maintenance and acquisition were the major educational activities referred to in this essay. Within accounts of the student memoirs one comment perhaps placed mathematics outside the cultural and language connections espoused in the later mathematics research of the 1980s and 1990s discussed earlier in this thesis in chapter. However, it should be noted that the Polish student who made this comment came from a European tradition of mathematics which implies some Western cultural connection with the traditions of the Australian Anglo-Celtic majority. The student, educated before the availability of ESL classes, commented:

The most oppressing thing was my being bottom in nearly all subjects at school as a result of my poor command of English. All the spelling tests, dictation tests and others, apart from mathematics, were like a continuous whipping of my ambition.....(Smolicz & Secombe, 1985, 131) (Researcher's underline)

The researcher was conscious of the need for specific comment on mathematics and the lengthy time period (50 years) involved which did not allow direct researcher observation of classes. The possibility of personal interviews of students and families was explored informally through preliminary contact made with ethnic clubs and associations, ethnic libraries and churches which revealed the possibility of an uncomfortable sensitivity about academic achievement and language expertise.

The decision was taken therefore to research the perceptions of the other figures in the classroom, namely the mathematics teachers currently teaching or retired who had worked in Victorian schools over the period of study.

#### *4.5.2 Exploring the perceptions of teachers*

Several questions could be explored through the perceptions of teachers. Did they perceive difficulties in the teaching of mathematics in ethnically diverse classrooms and, if so, what steps did they take to overcome them? What did they know or employ of the mathematics policy recommendations and management strategies of the macro educators? Were any resources provided from either outside or inside schools of use to them? To what extent did they perceive the need to create their own practical solutions? Was the ethnic minority presence problematic or advantageous to the teaching and learning of mathematics in their classrooms? Did the ethnic minority students bring to the mathematics classroom new ideas and practices, which in the perceptions of teachers, were worthy of exploration and incorporation into their practice? Were there achievement patterns in the mathematics performances of ethnic minority students? In proceeding with the use of teacher commentary, the perceptions of responses to the ethnic minority presence within the mathematics classroom will be investigated through the use of questionnaires and follow-up personal interviews of individual teachers working in Victoria over the period of this study.

#### **4.6 Macro educator response – sources of data**

In Chapter 5, the documentary evidence and commentaries used in investigating macro educator response will include both Federal and State government references. In areas of specific state response, Victoria will be the principal state concerned. In

relation to immigration, which is the domain of the Federal Government, policies and major events over each of the five decades will be presented as a background to an investigation of parallel education policies and management instigated by both Federal and State governments in all sectors.

#### 4.6.1 Events and policy changes in post-war immigration

To present an overall picture of Australia's post-war immigration, extensive use will be made of the work of immigration writers such as Castles et al (1998), Jupp (1998), Melliush (1998), publications of the BIMPR written by Hugo & Maher (1995), Maher & Stimson (1994) and the Commonwealth Census Year books (ABS).

#### 4.6.2 The macro educators and the ethnic minority

The researcher will draw heavily from relevant commentaries on government and sectoral policies and management written by such educational writers as Blake (1973), Clements (1989), Connell (1993), Ellerton & Clements (1994) and Horwood (1997). At the same time, in relation to mathematics education, the researcher will draw on relevant government education policy papers, advisory statements and regulations in documentary form. These will include educational reports of committees convened by the government such as the Ramsay Report (1960) and the Karmel Report (1972) and the educational aspects of immigration reports such as the Galbally Report (1978) and the Fitzgerald Report (1988).

### 4.7 Two Avenues of Response

Therefore two avenues of the response of the mathematics educators to ethnic minority students will be investigated. In Chapter 5 documentary evidence and published commentary will be used to examine the intentional policies of the macro mathematics educators in their responses to the ethnic minority over the period of study and results will be presented. A parallel chronology of major immigration policies and events will provide a background of immigration policy change over the five decades of the period of study. The research methodology used to investigate teacher perceptions of the implementation of response within the confines of their own classrooms, through the use of questionnaire and personal interview, will be described and the results will be presented in Chapter 6.

#### **4.8 Beginning with an investigation of macro response**

As was described in Chapter 3 macro responses to the needs of immigrant students were often housed under a broader cover of disadvantage with different foci such as socio-economic, language, intellectual difficulty and girls' education factors, so that there was some difficulty in singling out ethnicity issues. The estimation of response therefore became very complex. In order to clarify the tracing of macro response in each of five decades from the 1950s to the 1990s the most significant responses within the context of mathematics education within each decade will be treated in some detail. Some responses within a decade carried on and were further developed in later decades and some account of this continuation will be given. Each decade therefore will be investigated in the framework of the emergence of the major issue in mathematics classroom education relating to ethnic minority students during that decade.

In Table 10 the major concerns of macro educators in relation to the mathematics education of ethnic minority in each decade have been presented. The characterization of each decade has been selected as a result of investigation of commentaries and government papers concerning historical, social and mathematics education aspects which will be described in detail in the next chapter. The researcher chose this approach as a reasonable platform which could be used to compare policies and management described as the intentions of the macro educators with the perceptions of practising teachers in the classroom described as the implementation of mathematics education.



The five areas have been selected as illustrated in Table 10:

**Table 10 – Five decades of post-war mathematics education**

Decade	Major directions of mathematics education policy and management espoused by the macro educators. Connections of these with ethnic minority students.
1950s	<p><b>Classroom environment</b>            An anticipated shortage of resources both physical and human in schools due to the post-war baby boom and other factors.            A failure to recognize the added impact of a significant increase of student numbers due to immigration in accommodation and availability of mathematics teachers.            Particular difficulties in mathematics education resulting from a lack of preparation for the arrival of immigrant students in general and in particular, of ethnic minority students.</p>
1960s	<p><b>Language problems in mathematics</b>            A rise in the number of Non English Speaking Background NESB/ESL students to the extent that they constituted a majority in some metropolitan classrooms.            The problem of language in mathematics in the 1960s and its continuation in later decades.</p>
1970s	<p><b>Pedagogical change</b>            Radical changes in teacher roles and new pedagogy – individualistic mathematics curriculum where students as individuals proceeded at their own pace.</p>
1980s	<p><b>Curriculum change</b>            New Australian curricular designs - the importance of the mechanisms of problem solving in new mathematics cultures and assessment models - a clash with some ethnic minority cultures. Intensified language problems for ethnic minority students in the last years of secondary schooling.</p>
1990s	<p><b>Assessment mechanisms and numeracy concerns</b>            Unprecedented diversity in the origins of ethnic minority students - Political concerns about numeracy levels in Australia. Compulsory frameworks of curriculum and assessment devised by the Government. Broad differences in the mathematical backgrounds, abilities and basic skills brought to the mathematics classroom by the students of diverse ethnic origins.</p>

Chapter 5 will begin therefore with a study of macro educator policies in relation to the mathematics education of ethnic minority students in the 1950s.

## Chapter 5

### *Five decades of mathematics education in the classroom*

In Chapter 4 the areas of mathematics education which gained most prominence in each decade were established. In this chapter each decade will be analyzed in relation to how these aspects of mathematics education affected the teaching and learning of ethnic minority students in each decade. Did any of these significant events in mathematics education represent a direct response by the macro educators to the diverse ethnicities of students in mathematics classrooms as a result of immigration policy? If not, were there policy and management adaptations made in response to the presence of ethnic minority students in the mathematics classroom by the macro educators?

Within the policies and management of the macro educators it will be seen that, in some cases, the needs and consequent responses to ethnic minority students in the mathematics classroom were a subset of the needs of and macro responses to all students. In others the needs of ethnic minority students, were responded to in common with needs of other minority groups of students. For example, responses to language difficulties of ethnic minority students were linked with the needs of other students such as ethnic majority students who had special learning difficulties in language.

Also while a particular policy or strategy of management may have been recognized and commenced in a particular decade, it may have continued through subsequent decades and have evolved into a larger or different component of mathematics education. This became particularly evident to the researcher in the investigation of the connections of language with mathematics which was first recognised in the 1960s. In such a case a summarized description of further development in later decades will be provided.

In the first section of each decade, summaries of Australia's immigration policies and implementations over that decade will be provided as a background to descriptions of the aspects of mathematics classroom education relating to the changing

demographics of the student population. The main sources of most of this information were immigration writers such as Castles et al (1998), Jupp (1998) and Hugo and Maher (1991).

How then did the effects of immigration policy permeate the mathematics classroom? What pathways of communication and implementation to the practicum of the classroom were used by the bureaucratic offices of education? How difficult was the task of the teachers? What responses of these authorities helped or hindered teachers to adapt and change their modes of instruction in mathematics to meet the changing demands on their teaching created by the immigration policy? How much understanding of the culture of immigrant students was evident in the policies and management of the macro educators in mathematics education? How happy were the ethnic minority communities to commit the education of their students, including mathematics education, to the existing schools sectors? How much control was exercised by the macro educators in the designing and implementation of classroom mathematics programs? What was the nature and extent of any mandatory instruction of the macro educators to mathematics teachers within their classrooms?

### **5.1 The 1950s – mostly British immigration but not quite**

The original intention of accepting Anglo-Celtic immigrants was implemented in the post-war years of the 1940s together with some European immigrant intake of “Displaced Persons” from refugee camps, the latter motivated by humanitarian concerns. By the 1950s unmet labour needs necessitated a broader approach and immigration on a wider scale from Europe began, together with some admittance of immigrants from non-European countries.

It can be seen from the summary of immigration policy and events in Table 11 that the 1950s saw the beginning of intensive European settlement. Of this settlement Jupp wrote:

European settlement in the second post-war wave was essentially concentrated between 1952 and 1972.....most (European migrants) were not proficient in English and many have never learnt the language as they arrived at a time when English-language tuition was ineffective (Jupp, 1998, 111, 112)

**Table 11 – Immigration events and policies of the 1950s**

1950s	Immigration Events and Policies
	1950 - Good Neighbour Council launched nationally
	1951 - Assisted passage agreements with the Netherlands and Italy
	1952 - Assisted passage agreement with West German Government
	1954 - Assisted passage agreements for immigrants from Finland, Switzerland, Sweden, Norway and Denmark
	1955 - Arrival of millionth post-war immigrant
	1956 - Conditions for admission of persons of mixed descent clarified and eased
	1957 - Non-Europeans permitted to apply for citizenship after 15 years residence
	1958 - Migration Act passed, abolishing the dictation act and introducing an entry-permit system for controlling emigration
	1959 - Movement against White Australia begins in Melbourne

Adapted from chronology in Jupp, 1998

In 1947, two years after the establishment of post-war immigration by Mr A. Calwell, the then Commonwealth Minister for Immigration, an assisted passage agreement had been made with the United Kingdom, the population of Australia contained the components in Table 12.

**Table 12 – Origins and percentages of Australian and overseas born population of Australia in 1947**

Place of birth	Numbers	Percentages of Total Population
<b>Australian born</b>		
Aboriginal	87 000	1.1%
Native born settlers	6 635 171	89.2%
<b>Overseas born settlers</b>	744 187	9.7%
<i>Main sources:</i>		
Great Britain		6.6%
Ireland		0.6%
New Zealand		0.6%
China		0.4%
Greece		0.4%
Germany		0.4%
India,		0.1%
USA		0.1%
<b>Total Australian Population</b>	7 666 358	100%

Adapted from figures in Jupp 1998. Aboriginal figures were estimations.

Thus the largest component of the first wave of immigration was a high majority of British immigrants and this pattern continued into the 1950s. However as the decade

progressed more and more immigrants came from non-English speaking European countries. The acceptance of a relatively small number of non-European immigrants added to these figures.

#### *5.1.1 A convergence of unexpected student numbers and curriculum reform*

Connell described education in the 1950s in the following words:

The main problem of the 1950s was the practical one of enormous growth in the school population. It was a worldwide phenomenon which particularly affected the secondary and tertiary levels.

and

The large upward growth in secondary and tertiary enrolments was clearly apparent at the end of the 1950s and so, too, was the mid-twentieth century explosion of knowledge and technology dramatically emphasized by the successful launching of Sputnik in 1957. This combination of circumstances began to force educators to think seriously about the adequacy of existing structures and curricula to cope with the expanding and different needs of the next decades (Connell, 1993, 3).

The 1950s were characterized by the need to educate a student population, which had vastly increased in number in the post-war years. The reasons for this increase revolved around three increases which impacted severely on the provision of school education: a post-war baby-boom, a large injection into Australia's population of mostly European immigrants, and a new attitude to school education which translated into higher attendance and retention rates at secondary level.

Horwood wrote of this period as follows:

Rivalry between university and Education Department faded against a background of trying to cope with quantity. At the same time there was a struggle within curriculum because of a crisis of management within the state department and a change in attitude to education. The policy of development of each student's innate capacity replaced the policy of production of a social and intellectual elite (Horwood, 1997, 129).

Thus the sheer quantity of students was a major preoccupation of Australia's macro-educators and the adequate provision of both physical and human resources, became a

massive task. By the end of the 1950s an interaction between the larger number of students remaining at secondary school levels and changing attitudes to education resulted initially in further strains on the system. The introduction of the coloured rods of the Belgian-based Cuisenaire to bridge the gap between abstract and concrete operations in primary mathematics (Gattegno, 1960; Clements, 1987b, 1989) and the introduction of New Math(s) (Moon, 1986; Clements, 1989), derived largely from the United States, at the end of the 1950s and into the 1960s constituted a major change in mathematics education curriculum and a wave of American textbooks. The new physical resources and teacher training needs, which surfaced as a result, placed further strain on mathematics education resources. How much attention, in the turmoil of resource needs and curriculum reform, did the ethnic minority students, whose non-English speaking families were making new beginnings in Australia attract?

#### 5.1.1.1 Ethnic minority students left out of the resources calculations

The reality of government planning was that calculations in 1949 related to the needs of education resources in Victoria in the 1950s had been seriously underestimated by the management officers of the State Government. New buildings were ordered to accommodate 15,600 children which approximately equalled the population forecast in 1949 of the numbers for whom the Victorian Education Department would need to provide extra rooms (Badcock, 1973). Table 13 shows a revised estimate of numbers:

**Table 13\* – Revised estimated student enrolments, 1950-1960**

Year	Total Numbers
1950	240,000
1955	299,000
1960	358,000

\*These figures represent an extraction of total numbers from Table 19 (Badcock, 1973, 529).

Badcock described these population projections as follows:

An explanatory note commented that these estimates were conservative **not taking immigration into account** (Badcock, 1973, 529) (Researcher's emphasis).

Thus the accommodation of immigrant students in Victoria's schools, let alone any specifically designed resources within them, had not been foreseen. Speculations on the reasons for the omission of immigrant population calculations could include a bureaucratic breakdown in communication between the Commonwealth Government and the Victorian Department of Education. Perhaps the population of Australia had not accepted or understood the reasons for the policy of post-war immigration and was therefore ignorant of its implications. Travaglia, in an autobiographical account which included her parents' experience as part of the Italian-born ethnic minority arriving in the 1950s wrote:

My parents were amongst those who faced a country which was not convinced, despite all of Calwell's propaganda, that it either needed or wanted migrants  
(Travaglia, 1993, 6)

Certainly the final recognition of the existence of immigrant students seemed to create shock waves among the education authorities and politicians of Victoria in 1949.

Minister Brigadier Tovell (Victorian State Government Minister of Education) stated unequivocally:

Large expansion of school populations should have been foreseen and measures taken to overcome the shortage of teachers and buildings. I don't know how we are going to solve the problem (Morley and White in Blake, 1973, 386).

How then did the Victorian Department of Education provide for the 290,000 assisted migrants who settled in Victoria between 1947 and 1957 at least half of whom had to learn to speak English, and in the continuing years of increased numbers and diversity of immigrants arriving in Australia?

It will be seen later in this chapter that mathematics education, as one of the key compulsory areas of study in schools, was particularly affected by the lack of physical resources. This lack of physical resources was not the only hurdle to mathematics education in the 1950s. While all study areas were affected, mathematics, in particular found itself in a state of crisis created by an acute shortage of qualified

teachers, which, by the end of the 1950s was exacerbated by new directions in both primary and secondary curriculum and the need to retrain teachers. This training of teachers seems to have been restricted to technical aspects.

Clements described the training of mathematics teachers in the 1950s as follows:

In the 1950s and 1960s, pre-service and in-service education programs for teachers tended to be little more than sessions where mathematicians explained the mathematics structures of new topics or showed how new equipment could be used (Clements, 1989, 52)

#### 5.1.1.2 Not enough teachers, especially of mathematics

There was evidence of official underestimation in relation to teacher numbers similar to that of accommodation numbers. Badcock, in his description of teacher shortage at the time wrote:

Notwithstanding the recent investigation, in the early 1960s the seriousness of the teacher shortage in secondary schools was not fully appreciated..... James Mills, Chief Inspector of Secondary Schools from November 1958 to April 1963... predicted that, 'the population "bulge", which reached secondary schools in 1959, should provide from the beginning of 1965 an adequate number of trainee teachers to meet every demand in the field of secondary education.'..... But Reed, in his first report of Chief Inspector in 1963, saw 'adequate staffing as 'the greatest single problem in our schools' and expressed the view that optimism could 'hardly be justified earlier than 1966 or 1967' (Badcock, 1973, 544).

This shortage of mathematics teachers continued into the 1960s. Badcock stated:

From 1964 the resignations of mathematics and science teachers, as a 'direct result of the competitive bargaining of industry and commerce' gave rise to concern and comment (Badcock, 1973, 544).

However, in the Interim Report of the Committee of the Victorian Enquiry into Teacher Education of 1980, chaired by The Honourable Mr Justice Asche, the



preparation of teachers in the 1950s, in response to the baby boom AND immigration was described in more flattering terms:

At the beginning of the 1950's the preparation of teachers was about to undergo a great deal of change which was a response to a quickening in the birth rate combined with the effects of the new post-war immigration program. The most dramatic changes were to be the size and number of teacher institutions both in public and private sectors. In Victoria there was also a change from a viewpoint of teaching as a craft for which people could be trained as apprentices to teaching as a profession achieved through preparation at teaching institutions (Asche, 1980, 35).

The report described the final abandonment of the apprenticeship system of training, previously in place for some primary teachers, in 1949, its replacement by structured uniform teacher training and formal certification and the establishment of a technical teachers' training centre (later to become a college) in 1952. In reference to the years prior to the post-war period, the report was critical of the universities.

The report, however, made reference to the post-war period as a dynamic and progressive response to the shortage of teachers caused by immigration and the baby boom and the need for attitudes to curriculum. In reference to university attitudes to primary education it reported:

The university showed no sign of effecting any change and no other university (in Victoria) had yet been established. Despite all this, teacher preparation in Victoria was about to undergo unprecedented change. For almost three decades from 1950 there would be rapid developments in the growth, funding and control of institutions. At the end of this period there would be a growing awareness of sharp changes in the economy and demography of all Australian states, and a new perception of the immediate past would lead governments to question whether recent changes in teacher education had sufficiently altered its major characteristics so as to effect an improvement in the quality of teaching in schools (Asche, 1980, 40).

The non-Government sectors of school education were also affected by post-war development. In the Catholic sector prior to the 1950s teachers were members of religious orders who were trained in their own colleges which were supervised for the

Victorian Council of Public Education by the Victorian Education Department. The post-war baby boom and the immigration program swelled enrolments in Catholic schools who now began to accept lay teachers for training (Connell, 1993; Rogan, 2000). Rogan wrote of the connection between the 'Minister of Migration' Arthur Calwell and the Coadjutor Archbishop of Melbourne, Dr Justin Simonds. He described the role of Dr Simonds who,

was commissioned by the Australian bishops in 1945 to visit Europe and develop a possible migration program....Church and government worked closely together in bringing migrants to Australia and settling them here (Rogan, 2000, 63).

Like the Government schools the Catholic schools soon found their resources inadequate both in terms of physical and human resources. In a description of Catholic schools in Victoria between 1946 and 1960 Rogan wrote:

Up to 120 pupils in one classroom was not unusual (Rogan, 2000, 64).

This would surely have included mathematics classrooms because of its nature as a compulsory subject area in all schools.

The number of students attending the schools of the third sector of school education, namely the Independent school sector, while increasing, did not register the explosion of numbers of the other two sectors. The majority of these schools, which were involved mainly in secondary education, did not attract ethnic minority attendance in the 1950s. Their models in most cases were the single sex institutions of endowed schools in England. They charged substantial fees and, in most cases, conferred a commonality of culture which aimed at higher academic and/or social positions within the community (Connell, 1993).

Victorian Independent Schools from the mid-1940s offered their own courses in primary, sub-primary and junior secondary education at Mercer House and this lasted through to 1975 when it was absorbed into State College of Victoria Toorak. For three decades after 1950 there were rapid developments in funding and control of institutions. In Victoria from 1950 to 1973 the number of colleges increased from 3 to 13 and this was due in part to radical changes in the training of primary teachers.

However some ethnic minority communities in the post-war years, as early as the 1950s and 1960s, began to set up their own independent extensions of schooling. Connell wrote:

With the influx of migrants in the decades following World War II a large number of small part-time ethnic schools were developed by interested communities, usually in the larger cities. As a supplement to the ordinary school curriculum, they conducted classes at weekends or in the evenings, in the migrant language and culture for the children of the migrant community (Connell, 1993, 99).

In later years full time Independent schools and coaching schools were established by ethnic minority communities for ethnic minority students. Other institutions, in which mathematics was prominent in the curriculum, were weekend and after hours schools. Several students from one of the schools, which employed the researcher, attended Japanese School. This school had been had established for students entering tertiary education on their return to Japan.

#### 5.1.1.3 The effects of assimilation policy

Some ethnic minority communities, therefore, began to establish their own schools and in later decades some of these were directed specifically to instruction in mathematics. But what were the preoccupations of the ethnic minority students themselves in Victoria's crowded schools of the 1950s? The immigration policy at the time, as was described in Chapter 3, espoused the concept of assimilation. The major influences on education at the time, as discussed in Chapter 2, were those of Great Britain resulting in the heavy use of British texts in mathematics. It was seen also, in Chapter 2, that the immigration authorities printed material which reassured British immigrants that very little adjustment had to be made in the education of their children. Little evidence could be found of their reactions. Hill in an account of values education in Australian schools observed:

Required, as they were, to fit into the dominant Anglo-Celtic way of doing things, these newcomers were often grateful enough for the opportunity to start a new life that they were prepared to put up with the insensitivities of the policy of 'assimilation'. But, as often happens in migrant families, the children who at

first tried so assiduously to become indistinguishable from their Anglo-Australian peers then gained the confidence and curiosity to explore their ethnic origins. Many of them achieved positions of high office through hard work and were then in a position to draw attention to the need for a more magnanimous policy of 'integration' from which developed also the later rhetoric of cultural diversity (Hill, 1991, 74).

In a collection of short stories relating "growing-up" experiences of Italian women in the first decade of post-war immigration Dell'Oso wrote:

Sure, I knew I could have got together with others like me, dark-eyed children who also bought food cooked in olive oil and wrapped in butcher's paper. As it was, we ended up together at the same spots in the playground, looking out at the crowds of madly playing children beyond. But I'm ashamed to say I couldn't see the advantages of unity. We made each other uncomfortable. We were like mirrors at a fun fair, we didn't like to look into each other's eyes in case we saw ourselves reflected: freaks, misfits, wogs.

I knew I'd drop these children instantly if I could only just once hold the red handles of the skipping rope turning day after day in the middle of the playground (Dell'Oso in Travaglia et al, 1993, 50-51)

These two commentaries illustrated some of the underlying agendas which ethnic minority students were working through as they attended school. The crisis of accommodation, the teacher shortages of the 1950s and the beginnings of curriculum reform were very distant from the preoccupation described by these writers. There was a conflict of values; becoming as one with the existent Anglo-Celtic ethnic majority and using one's ethnic origins in ways which led to success and achievement.

So, did the management strategies which the Victorian government put in place to address the drastic shortage of resources, affect ethnic minority students in any way? As people emerging from the traumas of the Second World War how easy was it to learn in new buildings which looked remarkably like military installations and which, in fact, were derived from the designs of military installations in England. How did they respond to teaching of mathematics in a language foreign to them but not to the

majority of the class by teachers trying to cope with huge numbers of students? These questions will be addressed later in this chapter.

### *5.1.2 Managerial responses of the Victorian Government*

Its initial calculations for the requirements of increased physical and human resources having neglected to factor in the effect of increased migration, the Victorian State Government now took steps to rectify its lack of resources. Recommendations came from the first report of the Ramsay who later chaired the Ramsay Committee at the end of the 1960s.

Major-General Ramsay, previously Head Master of Melbourne High School and prior to his appointment as the chairman of the Ramsay Committee, observed educational trends in Great Britain – he submitted a first report of fifteen pages (published in the *Argus* circa 17.01.49) which recommended the abolishment of the junior-teacher training in place at the time and its replacement with a two year training course for primary teachers and a four year training course for most secondary teachers which was made up of a degree and a Diploma of Education. The secondary teachers' college was opened in 1950.

Ramsay's two firm convictions touching accommodation were that school buildings be standardised to allow speedier construction and that State funds for building be allocated to cover three to four years instead of one (Badcock in Blake, 1973).

#### *5.1.2.1 New buildings*

Badcock described new accommodation as follows

.....throughout 1949 plans were laid for prefabricated classrooms and tenders considered. By December the Public Works Department had ordered 195 double-classroom units, each capable of housing 80 pupils. These would accommodate 15,600, very close to the estimated 16,000 for whom the Department needed extra rooms (Badcock in Blake, 1973).

This number accommodated the student numbers according to the estimations calculated one year earlier. Consequently classes had to be taken in halls, staffrooms and shelter sheds and other inappropriate spaces (Badcock, 1973).

As a student in the early 1950s, the researcher remembers the dark windowless store-room of the book store where all Year 12 (Form 6) Mathematics (Pure Mathematics, Calculus and Applied Mathematics) was conducted – the teacher sitting on a high stool beside a blackboard easel and the students clustered tightly around a narrow table.

Badcock continued:

In England Ramsay had seen an army-type operation to build schools and had been particularly impressed by classrooms constructed of standard aluminium modules (Bristol units). He therefore strongly advised these for Victoria because, he claimed, they provided a very high standard of amenities, had a life of seventy years, could be readily adapted to changing needs, could be erected quickly, were pleasant and attractive to the eye, and could be built in many designs for all types of sites. Reputedly they suited enrolments of 100-150 (Badcock, 1973, 529).

These recommendations were submitted to Cabinet. Bristol units were installed in many schools where several are still in service in 2000. However the building crisis persisted until the end of the 1960s.

In 1951 900 secondary school students were without accommodation. By the late 1950s and 1960s the education of secondary students presented a problem of unprecedented magnitude. Other problems delayed building projects. The Minister of Education (Tovell) supported importation but it was then found that finance was not available to transport these classrooms to the required locations (Badcock, 1973, 531).

The situation became so critical in the secondary division that schools, rather than extra classrooms had to be built. To do this quickly, timber-framed, slab clad schools, the so-called "chicken coop" schools, were constructed. Most of these schools were built in metropolitan areas perhaps reflecting the urbanisation of

Australian society and the concentration of immigrants in urban areas (Badcock, 1973). Badcock wrote of the late 1950s:

This would be the pattern for some years ahead, with schools established in temporary quarters at other schools and in hired halls until their permanent quarters were complete or near completion (Badcock in Blake, 1973, 532).

The acute teacher shortage seemed to create an even greater problem particularly in the area of mathematics.

#### 5.1.2.2 A teacher crisis in mathematics

Badcock described other measures which had to be taken to alleviate the teacher shortage. One such measure involved efforts to recruit trained teachers in Scotland and England to take up duty at the beginning of 1958. The most important measure in 1957 was the institution at the Secondary Teachers College of a course of study for the Trained Secondary Teacher's Certificate, for which fifty-seven teachers enrolled. But the 1950s closed without noticeable improvement. In the report of 1959-59 the Chief Inspector stated:

'There is a shortage of trained teachers in almost all subjects of the curriculum ....The position is likely to remain difficult for some years'

Of particular significance was the 'grave shortage of mathematics teachers' coupled as it was with the growing tendency among boys to pursue the study of mathematics and science as far as the abilities allowed (Badcock in Blake, 1973, 537).

In the writer's own experience of teaching in the early 1970s a shortage of teachers persisted even then. Teacher training in Mathematics was not a prerequisite for teaching years 7 to 9 mathematics. Teachers whose teaching methods were as diverse as French and Home Economics and whose mathematical experience was no more than year 12 mathematics and sometimes a great deal less as a student at school, found themselves reluctantly pressed into mathematics teaching. The texts to which they clung tenaciously for help were generally first written and printed in pre-war England.

Badcock wrote of a report on the severe shortage of qualified secondary teachers of mathematics and science which was still problematic in 1966 as follows:

In a further analysis it was revealed that, of these 1,651 teachers of mathematics and science, 981 were classified secondary teachers, 194 were primary teachers working in secondary schools, and 476 were temporary teachers, of whom 282 had received no professional training (Badcock, 1973, 554).

At the same time, towards the end of the 1960s, and contained within the Ramsay Report of 1960, coincident changes to new, more individualistic approaches in pedagogy and new curriculum allegiances in mathematics education were evolving. In the face of the paucity of rooms, the large numbers of students and within these, the presence of non-English speaking students and the lack of teacher training in mathematics education, mathematics teachers of the late 1950s were being confronted by huge challenges.

### *5.1.3 Educational transitions from the 1950s to the 1960s*

Thus, by the end of the 1950s, the resource shortfalls in accommodation and teaching were still present. These were particularly evident in mathematics education at secondary level which had retained its important status as a compulsory subject at most levels of school education. The status and content of mathematics education were still influenced by their inheritance of British-based elitist philosophies and a curriculum largely influenced by the universities. However, change was in sight and new ideas in curriculum and pedagogy were beginning to evolve. In the Ramsay Committee Report of 1960, instigated by the State Government of Victoria, a major item listed for change, was the need for curriculum reform. The Ramsay Committee of 1960 wrote:

".....within the limits of available material provisions a system of education must consider the importance of individual differences and varying rates of development" (Blake, 1973, 415).

What then were the responses of the macro educators to ethnic minority students in the mathematics classroom?



#### *5.1.4 Responses to the ethnic minorities – a summary*

A summary of responses of the macro educators of the 1950s to the ethnic students in mathematics education in the light of the resources concerns would seem to contain little evidence of response at all. The overwhelming shortage of resources preoccupied the macro educators but perhaps some relevant issues emerged.

- The alienating effects of the assimilation policy meant that ethnic minority students were largely ignored by the ethnic majority. Whether the lack of teacher and student attention in the mathematics classroom was harmful is debatable. The Baltic students in the description of the researcher's personal experience described in Chapter 1 were highly motivated and were able to progress in class. However the description of the unhappy effects of segregation described by an Italian student in Section 5.1.1.3 represented a direct contrast to these experiences. There were differences in the experiences of ethnic minority students in the assimilation period.
- The Ramsay Report which supported the pursuit of educational curriculum for the individual offered hope of recognition of particular strengths or difficulties of ethnic minority students in all subjects including mathematics. This represented a change from the past in which the role of the teacher was largely that of a director disseminating knowledge in a way that did not invite overt student interaction except in a highly controlled way.
- Lack of accommodation and teachers trained in mathematics were disadvantageous to all students but steps were being taken to correct this. Management strategies, however were borne of desperation and were, of necessity, basic and utilitarian. Problems were still evident at the end of the decade.
- The beginnings of consolidation of ethnic minority groups in education through the establishment of culturally specific part-time schools were established.

How much harmony existed then between mathematics education policy and its management, and the immigration policies and events of the 1960s?

## 5.2 The 1960s – Language, mathematics and the ethnic minority

In the 1950s some consideration had been given by education and immigration departmental authorities to the problem of language but this was not built around the anticipation of the larger proportions of non-English speaking immigrants which eventually had to be imported beginning in the 1960s, to make up for the shortfall in British immigrant numbers (Jupp, 1998; Connell, 1993). As can be seen in the chronology of immigration policy and events in Table 14, the ethnic origins of immigrants in the 1960s covered a wider European base and had broadened to the acceptance of non-European immigrants. These immigrants essentially were non-English speaking.

**Table 14 – Immigration policies and events of the 1960s**

1960s	Immigration Policies and Events
	1960 - British subjects with permanent residence permitted to bring their non-European spouses and unmarried minor children into Australia.
	1961 -
	Aboriginal population            117 495    =    1.1% of Australian population
	Native-born settlers            8 729 406    =    82.2% of Australian population
	Overseas born settlers            1 778 780    =    16.7% of Australian population
	Total Australian population    10 625 681    =    100%
	1964 - Assimilation Section of the Department of Immigration becomes the Integration Section
	1965 - Major parties remove White Australia from platforms In inner Melbourne large numbers of non-English speaking students began to appear.
	1966 - Substantial modifications of White Australia Policy Federal Government decision encouraged highly skilled non-Europeans to settle in Australia. R. G. Menzies retired
	1967 - Migration agreement with Turkey.
	1968 - Czech and Slovak refugees arrive in Australia, following the Warsaw Pact invasion of Czechoslovakia.

(Table incorporating material from Jupp, 1998)

Jupp described Federal Government priorities in relation to the social needs of ethnic minority immigrants at the time:

Between 1945 and the 1980s, settlement policies were steadily developed, mostly under the auspices of the department of immigration, to address the social problems inherent in mass migration. The teaching of English was the most expensive of the services offered under these policies (Jupp, 1998, 168).

He described also a perception of public policy which was the assumption that:

..... immigrants who could not speak English faced serious barriers to social progress, barriers that were caused mainly by language rather than by race or religion. By 1978, as a result of the Galbally Report, the category 'non-English speaking background' (NESB) had been invented. This label described both first-generation NESB immigrants and their second-generation NESB Australian-born children.

However Jupp also observed:

...that considerable social progress had been made by the children of immigrant parents; these children frequently perform better (in many areas of life) than do native-born Australians and children of British immigrants (Jupp, 1998, 169).

### *5.2.1 Problems of language and a refusal to be "assimilated"*

Chapter 2 described the radically changed immigration pattern of the 1960s, and the concentrations of ethnic minority students which appeared in the urbanised cities of the eastern Australian coast (Jupp, 1998; Castles et al, 1998; Hugo and Maher, 1991). Coincident with the formation of these new demographical student patterns, there appeared a growing confidence on the part of the ethnic minority community as a whole, in its own identity and in its new-found ability to make itself heard as a political entity. Jupp described the growth of the 'ethnic lobby' as slow but becoming a force by the late 1960s (Jupp, 1998). The advice to ethnic minority families by the immigration authorities of the 1950s, in the assimilation period, to "disappear" into the predominantly Anglo-Celtic population (Chapter3), had by the 1960s, been met by some rejection (Clarkson, 1991; Castles et al, 1998; Jupp, 1998).

#### 5.2.1.1 The irrelevance of English and the end of the Assimilation Policy

The ethnic minority communities of the 1960s were able to consolidate networks which conducted businesses and supplied essential requirements. To speak English within the family and in its social environment was unnecessary. Employment in labouring and factory environments required little English. The need to communicate reasonably fluently in English was not seen as a major priority among some of the ethnic minority communities as their networks grew larger. Adult classes funded by the federal government in English were poorly attended by males and often were not attended at all by females (Connell 1993; Blake 1973). Personal difficulties such as tiredness, shift work and educational background contributed to lack of attendance (Morley and White in Blake, 1973). Ethnic minority students, **even those born in Australia** of ethnic minority parent born overseas, began their primary school education, having never communicated at all in English. A lengthy school education in English appeared to have little relevance to immigrant families, particularly those from Southern European countries, when money, housing and success, unobtainable in the immediate aftermath of post-war hardship in their own countries, could be earned by entering employment. Their children tended to leave school relatively early during their secondary education to begin employment. However, according to Castles et al (1998), education had not been dismissed by ethnic minority families. The fact was that the assimilation policies of the 1950s and early 1960s had meant that ethnic minority students found themselves in normal classrooms without any help in the learning of English or in adaptation to the new environment. This lack of attention to the needs of ethnic minority students combined with a lack of reinforcement of English skills available in their homes and communities meant that academic failure in the ranks of ethnic minority students was often the end result (Castles et al, 1998).

As a result, the ethnic minority communities of the time and their children embarked on heavy working schedules, often maintaining a frugal existence while acquiring economic stability for their families. It became evident to the Federal government of the day, by the mid 1960s, that the whole policy of assimilation had begun to crumble. As a result, in 1964, the title Assimilation was dropped and a new title, namely Integration, was used to describe Australia's immigration policy. Integration later proved to be a transitional phase, which broadened in the next decade into

Multiculturalism, a phase which persisted into the 1990s. The attitudinal change, which came with the integration phase, was the acknowledgement and recognition of ethnic differences within Australia's population. This change became a defining influence on Australian life and one which was eventually directed towards the education of its children.

#### 5.2.1.2 Teacher distress in overcrowded inner city classrooms

While in the earlier 1960s resources continued to preoccupy the macro educators, particularly in secondary education, as will be seen later in this section, teachers were beginning to react against the stress of these resource shortfalls and to exert some influence. The lack of English of the ethnic minority combined with large classes and inferior accommodation created in their view great impediments to effective teaching. Castles et al wrote of the contradictory influences at work during to the assimilation policies of the 1950s and the early 1960s:

Linguistic and cultural maintenance was discouraged. Serious problems arose in overcrowded inner-city schools, where teachers found it hard to cope with large numbers of children from diverse backgrounds (Castles et al, 1998, 99).

Connell wrote:

The emphasis on assimilation through school discipline, conformity and learning the English language was not seriously challenged until non-English speaking migrants clearly began to outnumber those whose native language and culture was English in the latter part of the 1960s. Up until that point, there was much complacency about the ease with which migrant children adjusted to school and adapted themselves to Australian culture (Connell, 1993, 460).

However by the end of the 1960s a survey of schools revealed that, within a five mile radius of the centre of Melbourne, ethnic minority students constituted at least one third of the school student population and that this figure in some schools exceeded 70% (Connell, 1993).

In 1967, the Victorian Department of Education appointed a co-ordinator and advisor on migrant education, the first in Australia, and this was followed by short training courses for teachers of English to ethnic minority students. Later in this Chapter the

extent of macro educator intervention will be described in more detail. It was clear, however, in the 1960s, that the problem of language in the classroom had to be urgently addressed.

What language problems then did the mathematics classroom experience at this time? How did a lack of English speaking skills impinge on the teaching of a subject which was seen as important by all the most powerful and complex societies of the world and one which had a degree of international agreement in these societies about its content and curriculum. In Victoria, the masses of students now taking mathematics, particularly in the secondary division as a result of the Ramsay Report which focussed on each student as an individual in an era of curricular reform in the 1960s, created added pressure on the practitioners of mathematics education.

#### 5.2.1.3 The pressure of other connected change on the classroom mathematics teacher of the 1960s

The problems of resource shortages and the diversity of languages were not the only concerns of mathematics teachers. The voices of mathematics teachers were being heard also in curriculum reform which represented a break away from traditional links with British models of the previous years. Ideas were being sought from teacher representatives and from overseas educators, in particular from American mathematics educators (Horwood 1997, Connell, 1993). In Victoria, between 1955 and 1965 the Mathematics Association of Victoria (MAV), an organisation representing secondary and tertiary mathematics teachers at this time, (in conjunction with the Curriculum and Research Branch of the Victorian Education Department), was a strong force in devising change in mathematics education. The MAV played a major role in the innovative introduction of Cuisenaire and New Math. into Victorian education in this period. It can be seen that, as a result of curriculum reform, the need to communicate at an individual or smaller group level so that **all** students could be accommodated in meaningful mathematics learning now had to be incorporated into mathematics teaching. Language skills therefore now occupied a larger dimension in mathematics **curricula** which, previously in the 1950s, had excluded many students through **an** attachment to elitist ideals based on university expectations. The lack of English needs of ethnic minority students in the teacher-centric practice of mathematics teaching in the 1950s and early 1960s classroom, now had to be

addressed in name of mathematics accessibility for a broader range of students. In addition to directing their attention to the needs of diverse ethnic minority students teachers had to undertake training in the new disciplines of New Math (secondary schools) and Cuisenaire (primary schools).

### *5.2.2 The response of the mathematics macro educators of the 1960s to language problems of the ethnic minority*

An element of the 'unexpected' which was present in the 1950s in relation to provision of educational resources by the macro educators seemed to be present also in the 1960s when the British intake of immigrants had already dropped to 44% by 1961 (Connell, 1993) and the majority of immigrants were non-English speaking. Certainly, in Victoria, adult English classes were being provided at *hospitals, prisons, rehabilitation centres, factories, women's classes and reception centres* (Morley and White in Blake 1973, 1117). By 1963 the migrant Education Branch was providing evening classes through reimbursement by the Federal government to the Victorian Department of Education which paid the teachers (Morley and White in Blake, 1973). However, as was seen earlier in this chapter, many migrants were showing a disinclination to learn English.

In contrast to the time lag response in education the need to supplement Australia's workforce had been entirely justified. By 1965, an increase of up to 80% in Australia's work force had contributed admirably to the manufacturing and construction industries (Connell, 1993). In 1966 significant changes took place - the White Australia Policy which had shaped immigration policy was effectively discontinued (although its official cessation occurred in the early 1970s), decimal currency was introduced, Aborigines were included in the government census of the Australian population. In keeping with these changes a change of attitude towards the education of the ethnic minority began to appear.

Governments both at Federal and State level in the latter half of the 1960s decade began to recognize the need of the ethnic minority population for language teaching. In 1967 the Victorian Department of Education appointed a coordinator and adviser on migrant education, and, this was followed by short training courses for teachers of English to the ethnic minority population. State professional educators and political

parties began to seriously discuss the education of ethnic minority children. At the same time greater participation of the Federal government in all levels of education was sought (Connell, 1993). However, by the end of the 1960s an evaluation through the auspices of forums of discussion of bodies called Australian Citizenship Conventions arrived at disturbing findings. These findings referred to the language acquisitions of 'migrant' children of non-English speaking families as follows:

- One third of migrant children in both government and non-government schools had persisting language difficulties which restricted their comprehension of school work in general.
- Many migrant students did not manage to make the full progression through secondary school.
- Parents were unable, in many cases, to provide an environment which encouraged children to stay at school. The fact that a significant number of migrant parents in inner city areas had not themselves experienced schooling beyond primary level contributed to this problem.
- Sampling of 8000 children attending school within a five mile radius of the centre of Melbourne children revealed that 85 percent lived in homes where English was never or rarely spoken (Connell 1993). 63 per cent of those whose school progress was rated as poor came from homes where English was not spoken.

Connell wrote in reference to this 'background' paper:

The background paper pointed to the need for a greater recruitment and training of special teachers in the area of teaching English as a second language and their employment on intensive remedial work with small groups in schools (Connell, 1993, 461).

### *5.2.3 Classroom mathematics and language in the next decades*

Thus the 1960s ended on the hopeful note of the recognition of language as one of the individual needs of ethnic minority student and steps were put into place through a combination of Federal funding and State management to address this need. This co-operative enterprise was recognised by Morley and White in the following words:

Migrant education supplied an outstanding example of Commonwealth and State co-operation in a very important field (Morley and White in Blake, 1973, 1120).



In fact, the findings of the 1960s stimulated the Federal Government to establish in 1970 the Federal Child Migrant Education Program (CMEP). In the next five years, the Federal Government funded salaries for teachers and supervisors of special classes of ethnic minority students in government and non-government schools. Also provided were the cost of training courses in TEFL (Teaching English as a Foreign Language) which was later named TESL (Teaching English as a Second Language), language laboratories and suitable teaching materials designed by what was now titled the Federal Department of Education. The newly elected Labour government of 1972 supported this program and used the Schools Commission, established in 1973 to establish Task forces in each state and the Committee on the Teaching of Migrant Languages in Schools (Maher Committee) in 1974. A variety of activities related to migrant education followed which involved the Department of Education, Schools Commission, Educational Research and Development Committee (ERDC) and the Curriculum Development Centre (CDC) (Connell, 1993). In 1975 the Victorian Department of Education listed the teaching courses related to language and ethnic minority education in Table 15.

**Table 15 – TESL courses available to teachers in 1975**

<b>Institution</b>	<b>Course</b>	<b>Remarks</b>
State College of Vic at Burwood	TESL	Primary
State College of Vic at Coburg	Theories and procedures of teaching English/conversion /Grad Diploma	Primary
State College of Vic at Frankston	TESL	Primary
State College of Vic at Hawthorn	TESL	Secondary/technical schools
La Trobe University	Dip. Ed. (Migrant Ed.) B. Ed. TESL I	Sec/adult Optional - 22-23 days prac teaching or Elective - socio-cultural aspects and broad organisation of migrant programs in schools.
Monash University	Methods and practice of teaching TEFL (a).Optional method Dip Ed (b) Advanced FLE B Optional 2 semester B.Ed (c) Immigration - an Inter- cultural approach Optional B.Ed (d) Ed Anthropology - cross cultural perspectives – optional B. Ed	(a) Sec (b) linguistics (c) Sec (d) Sec
State College of Victoria Institute of Catholic Education Mercy College	Migrant education studies Compulsory Dip Primary teaching	Primary
State College of Victoria Institute of Catholic Education Christ College	TESL optional unit in Dip Ed Primary Teaching	Primary
State College of Victoria at Melbourne	TESL I and II - 2 optional subjects in TSTC	Prim/sec/rem
State College of Education, Rusden	(a) Higher Diploma of Teaching (Secondary education) - for teachers specialising in Eng Lang studies (b) Diploma of Education (c) In-service course in Migrant Education (d) Optional TESL in Curriculum and teaching Dept- higher Diploma of Education. Teaching (Sec)	(a) Units available Language Acquisition The use of language in everyday life Language and education Language in communities The migrant and the community TESL Occupational guidance The teachers and the helping arrangement. (b)The migrant and the community TESL Occupational guidance The teacher in the helping relationship (c) The migrant and the community TESL (d) secondary

Taken from Australian Department of Education, *Bulletin, September 1975, Victoria, 6*

How then did these activities relate to Victorian classroom mathematics education? What responses of the macro educators to the problems of language impinged on mathematics education practice within school?

#### 5.2.3.1 Human resources and language in mathematics

As early as the 1950s, the importance of language in children's mathematical learning was recognised (Clarkson, 1991). The necessity of acquiring **the ability to read the question** had been recognised throughout the 1950s and 1960s, and to that end, after the recognition of the language needs of ethnic minority students in the late 1960s, the ESL teachers of the 1970s and later years were used in Australian mathematics classrooms schools to assist ethnic minority students to "understand the question". Most of the ESL teachers were not highly qualified in mathematics and their presence or assistance was found to be of limited value in the mathematics classroom. It will be seen in Chapter 6 that a significant number of the practising mathematics teachers taking part in the collection of data related to human resources within the classroom, stated their preference for teacher aides who were mathematically competent native speakers of the same language(s) as their students. Simple explanations of the English meanings of the words of the mathematics question were found to be only one of interactive connections between language and the learning of mathematics in the classroom. However, there seems to be little evidence of macro educators responding to teacher voices in this preference although several schools employed ethnic minority aides in the teaching of mathematics. In an inquiry into teacher education in Victoria ordered by its Legislative Assembly, as late as the 1980s, the following statement appeared under the title "Teacher Selection" in a chapter about Multicultural Education:

15.11 While academic preparation is obviously necessary, it is stressed that a teacher's personality, character and background are equally, if not more, important. Some argue for positive discrimination towards bilingual and bicultural candidates whose knowledge of the language, culture and settlement experience of a particular group within Victoria would be a valuable asset in schools. The Victorian Aboriginal Education Consultative Group, for instance, presented a strong case "that Aborigines are best equipped to work with other Aborigines in education, training and social or emotional development." (Asche, 1980, 266)

Some practical help, however, was available to Victoria's mathematics teachers through responses of the macro educators in the form of publications designed to assist mathematics teachers in coming to terms with language problems. Thus the recognition of the need for language resources in the 1960s led to substantial responses in later decades.

#### 5.2.3.2 Victorian language-based resources specific to mathematics education

An interesting example of a cooperative project in Victoria involving a teacher educator and a macro educator authority can be found in the work of Thomas (1986), who wrote a book for the use of mathematics teachers with significant numbers of ethnic minority students in their classrooms. This publication, titled *Number ≠ Maths*, contains material of practical help to mathematics teachers working with ethnic minority students and is quite unlike the numerous research papers which have addressed the connections between language and mathematics teaching and learning. The funding for this project came from the Ministerial Advisory Committee of Multicultural and Migrant Education (MACMME), although a disclaimer printed in the front of the book stated that the contents *do not necessarily reflect Ministry of Education policy* (Thomas, 1986, front page).

In this book, Thomas wrote:

Language and mathematics has been clearly identified as a national concern in Australia. The format of this publication is such that it may be part of the school's reference material as it stands or be placed in a folder and additional material added. Additional material that attempts to meet the needs of a linguistically and culturally diverse society will become available from a variety of sources in the next year or so. These sources include the Mathematics Curriculum and Teaching Program, Basic Learning in Primary Schools, Language Education Unit, the Participation and Equity Program and Curriculum Branch (Thomas, 1986, 3).

In a later research paper Thomas wrote of the disparity between the amount of literature which helped teachers to develop a theoretical framework for the linguistic and cultural aspects of mathematics education and the much smaller availability of

publications about strategies and materials for use in the classroom (Thomas, 1997). Some examples of resources developed for the use of classroom mathematics teachers of ethnic minority students were written in the 1980s and 1990s. These included literature written by Ballagh and Moore, 1988 and MacGregor and Moore, 1991.

#### 5.2.3.3 Research and the factor of language in mathematics education

It was not until the 1980s, after substantial work in the United Kingdom that research in Australia turned its attention to language factors in mathematics education in a broader context. Clarkson described this interest as follows:

Australian mathematics educators became more and more interested in theories of learning advocated by language educators and psychologists such as Vygotsky, (1986), Graves, (1983), Cambourne, (1989), Goodman, (1986) and Smith (1988) (Clarkson, 1991, 41).

Clarkson alluded to the possibility that the formal code of mathematics language in the classroom was a construction of white middle class Western males and that assessment procedures were discriminatory against, among other groups, children from non-Western cultural backgrounds (Clarkson, 1991). If this indeed represented the directions of Australian classroom mathematics, then later ethnic minority students of the 1960s and the following decades, faced disadvantage, arriving through the virtual end of the White Australia policy in the 1960s and the broadening of immigration policy to increase its proportion of non-Western peoples. In Chapter 6 this question will be investigated through a study of the participation and achievement of ethnic minority students in mathematics.

In the 1980s and 1990s the question of language factors as part of cultural connections to mathematics learning broadened to a study of the connections between culture and mathematics. Researchers included Bishop (1988), Clarkson (1991), Cocking and Mestre (1988), Dawe (1983), Ellerton and Clarkson (1996), Mellin-Olsen (1987), Nunes (1992), Secada, (1992), Stigler and Baranes (1989), and Tate (1994). Research into the significance of the values and beliefs teachers bring to the mathematics classroom continued to an extension of the notion that effective mathematics education was not about a purist neutral discipline in the classroom. As was seen in Chapter 3, there was considerable macro educator response, which

involved funding and resources, to the connections of culture and language to mathematics education in the Aboriginal communities of Australia in the 1980s. Certainly in the area of language some macro educator response took place, for example in the provision of ESL teachers after the language problems of the 1960s. However, despite the evidence in a wealth of theoretical literature up until the end of the twentieth century, there has been little evidence of practical response by Australia's macro educators to the connections of mathematics education with the languages and cultural differences of the ethnic minority created by Australia's twentieth century immigration policy. Thomas' comment about the necessity of better community understanding may be a reason for the fact that

Many, but certainly not all, mathematics educators in Australia now accept that teaching mathematics in Australia means teaching a culturally bound subject (Thomas, 1997, 35) (Researcher's emphasis)

In the 1970s a survey of children's performance in literacy and numeracy concluded that children from non-English speaking homes were generally unable to perform at the levels of their peers (Keeves and Bourke 1976). In relation to these findings Clarkson described the lack of impact that this survey had on school practice in terms of a reluctance of teachers and their educators to change, as follows:

Many teachers and lecturers have still not been touched by any new attitudes (Clarkson, 1991).

American research beginning in 1979 had reached the conclusion that children who were bilingual had a better chance of succeeding, if their first introduction to institutionalised education was in their native language through teachers who spoke their native language or through the help of community members (Cummins, 1979). Little recognition of this theory was applied in Australia, to the mathematics education of ethnic minority students, (although it attracted some attention in the education of Aboriginal children) (Dawe, 1983a; Clarkson, 1991). An Australian difficulty lay in the fact that often, multiple native languages were spoken by ethnic minority students within the same mathematics classroom. However, another philosophy seemed to militate against Cummins' theory. There seemed to be little recognition on the part of Australia's mathematics educators, that the possession of a language other than English by a student and the knowledge and the understanding of

another culture which this implied, could be thought of as an advantage to the student or to the mathematics classroom in general. The general perception of mathematics educators that the ethnic minority was disadvantaged, which was discussed in some detail in Chapter 3, had remained persistent in the 1960s and in later decades.

#### 5.2.4 Responses to the ethnic minority population in the 1960s – a summary

The problems brought to mathematics learning by a lack of English language skills were recognised in the 1960s and the process of responding was begun by the macro educators' responses. However it would seem that this response was slow and problems persisted. In the 1980s and 1990s research indicated that, as well as the recognition of teachers that students needed to understand the English of questions and instructions, teachers needed to be aware of the different ways in which different cultures employed their own languages of their mathematics. To complicate response to these questions of language the diversity of countries of origin of the immigrant population was increasing.

A summary of responses of the macro educators in relation to language included:

- The Ramsay Report which recommended that all students be given access to mathematics which was appropriate to their individual capabilities.
- The end of assimilation and the beginning of the integration years which recognition of ethnic minority students in the classroom.
- The Commonwealth Government commenced the training of teachers in English as a second language. This program was extended in the next two decades and ESL departments became part of schools with ethnic minority numbers. However progress was very slow in this direction and ethnic minority students continued to experience restriction in their progress at school.
- The reluctance of macro educators to recognize the value of ethnic minority teachers in mathematics classrooms in later years.
- The focus of research on language in mathematics and its relation to culture in later decades and related resources prepared by Thomas and others made little impact on mathematics policy and management.
- The stimulus in the 1960s for these responses included teacher distress in inner city schools where there were large numbers of ethnic minority students in the

mathematics classroom which now needed to address the individual needs of students.

- A rejection of English as ethnic minority communities consolidated through extensive networking, using their own languages.

The next decade in the mathematic education of the 1970s continued into a further extension of pedagogy shaped to cater for individual needs when some extreme manifestations of the concept of mastery learning were introduced to Australia's mathematics classes. This concept was a product of American research. How did the master educators of the 1970s adapt theory to the practical needs of students in Australian schools and in particular to the needs of ethnic minority students who after the late 1960s, came increasingly from non-European, non-English speaking countries? How individualism and ethnicity in mathematics education were responded to, will be described in the following section.

### **5.2 The 1970s – Changing patterns of both immigration and pedagogy**

The 1970s marked the co-incidence of change both in immigration policy and in the pedagogy of mathematics education. The relationship between these simultaneous changes will be discussed in some detail later in this section. However they could both be seen as continuations of the previous trends of the previous decades in that political impetus impelling immigration policy was gradually creating a higher diversity of ethnic and cultural diversity in Australia's population and mathematics education had begun, since the 1960s, to embrace the ideal of a pedagogy addressed to students as individuals.

#### **5.3.1 *Changing patterns of immigration in the 1970s***

In Chapter 3, it was seen that Australia's immigration policies were always circumspect. Acceptance of immigrant peoples on humanitarian grounds had always played a part but a larger consideration was the need to redress a dearth of population in a large country in order to meet specific shortfalls. Up until the 1970s post-war immigration served the need to redress labour shortfalls with "racially-acceptable" people who possessed similar cultural backgrounds namely British immigrants. It was seen earlier in this chapter that, by the 1970s the shortfall had been redressed but not just by British migrants. In order to fulfil its needs it was necessary for Australia



to initiate larger scale European immigration. By the 1970s the acceptance of non-Europeans had begun. This was coincident with a new need of Australia for industrial, business and technological expertise. A concentration of prowess in these attributes was concentrated much closer to Australia in the Asian countries of the Eastern Pacific coastline and on the sub-continent of India. Australia, on embarking on this immigration policy, became more selective in its acceptance of immigrants, at first reducing the numbers and, by the late 1970s, instituting a new set of criteria for the selection of immigrants which was a points system based largely on business expertise and its associated skills (Wooden et al, 1994). This marked a change from the selection procedures of earlier years which contained remnants of the White Australia Policy and which was shaped by the historical pre-war sensitivities of a relatively homogenous Anglo-Celtic population. In chapter 3 the theoretical framework of this thesis was founded on research findings which concluded that effective teaching and learning of mathematics was closely associated with understanding and acknowledgement of cultural factors operating within the classroom. In what ways then, did the macro educators of the 1970s respond to changes in the ethnic origins of mathematics students as a result of change in immigration policy?

The 1971 Commonwealth Population Census showed that 40% of Australia's population consisted of immigrants and their children of whom half were not native speakers of English. In the 1970s two important changes occurred in the migrant pattern. Firstly Australia accepted immigrants at less than half the rate of immigration of previous years. Secondly the number of non-Europeans within this intake increased considerably. Between 1971 and 1975 only 284 000 migrants arrived, the lowest number in any of the previous five year periods, compared with the highest number, 600,000 between 1966 and 1971. During this period migration from the United Kingdom and Eire dropped to 40% of the total intake (Connell, 1993). Table 16 lists some of the details of immigration in the 1970s.

In the time span 1976-1980 immigration dropped further to an intake of 28,000. Immigration from the UK and Eire fell to 20% of the total intake. Up until 1971, migrants from non-European countries totalled 15% of all migrants. By 1977 their numbers had climbed to 50% of the total intake of which South East Asians

numbered 27%, overtaking the numbers of British migrants for the five year period of 1976-1980. It was a speedy increase which put total numbers of South East Asians ahead of Greek settlers and not far behind the Italians for the whole 33 year period of 1947-1980. Among Greek and Italian settlers between 1971 and 1980 there were more departures than arrivals (Connell, 1993).

**Table 16 – Immigration policies and events of the 1970s**

1970s	Immigration Policies and Events
	1970 - Migration Agreement with Yugoslavia
	1971 - Bonegilla Camp closed
	Aboriginal population 150 076 = 1.2% of Australian population
	Native-born settlers 10 026 244 = 78.6% of Australian population
	Overseas born settlers 2 579 318 = 20.2% of Australian population
	Total Australian population 12 755 638 = 100%
	Breakdown of overseas born settlers.
	UK and Ireland 1 088 210
	Southern Europe (includes Italy, Greece, Yugoslavia, Malta, Cyprus) 669 450
	Rest of Europe 452 085
	Oceania is mainly New Zealand 97 927
	Middle East (includes Egypt, Turkey, Lebanon and Iran) 44 352
	North America (includes USA and Canada only) 42 873
	Southern Asia (includes India, Sri Lanka and Afghanistan) 39 960
	Southeast Asia (includes Vietnam, Philippines, Malaysia and Indonesia) 38 440
	Africa (includes South Africa but excludes Egypt) 33 709
	East Asia (includes China, Hong Kong, Taiwan, Japan and Korea) 28 113
	Latin America 12 879
	2 547 008
	1973 - Labor Government announces that future immigration policy will not distinguish between immigrants on the base of race, colour or nationality.
	1975 - <i>Racial Discrimination Act</i> passed by Commonwealth
	1976 - First Vietnamese refugees arrive by boat. The Department of Immigration became the Department of Immigration and Ethnic Affairs.
	1977 - Australian Ethnic Affairs Council established.
	1978 - Galbally Report on migrant programs and services
	1979 - NUMAS points system introduced for migrant selection

Taken from Jupp, 1998, 190, 191

### 5.3.2 *Changing macro educator structures and policies*

Increases in education expenditure in the 1970s reflected an increase of involvement of the Commonwealth Government and also a demand for education within the wider society. The AEC (The Australian Education Council) which had been composed of State Ministers of Education now admitted, as a member, the Commonwealth Minister of Education (Connell, 1993; Horwood, 1997). This increased involvement survived a change of government in 1972 at which time the Labour government came to office in Federal Parliament. Education had become an important political issue.

#### 5.3.2.1 Commonwealth Government intentional policies and actions of the 1970s

The Labour government, immediately on taking office, appointed the Interim Committee for the Australian Schools Commission under the chairmanship of Professor Peter Karmel, which subsequently presented its report entitled *Schools in Australia* (referred to in common usage as the Karmel Report), in the following year. This report identified schools as the agent of provision of more equal educational opportunity to students whose environmental situations were varied. It advocated that:

If developed ability is affected by environmental influences, the provision of more equal opportunity requires that schools should not concentrate on treating all children alike and selecting the best. .... Attempts to make the school more effective in its contribution to developed ability are favoured by the Committee in full awareness of the limitations of their potential power. These attempts include remedial services, and supplementary grants to schools containing a high proportion of disadvantaged children... They also include experimentation with a variety of forms of schooling, of learning and of joint school-community projects in an attempt to bring the school into a more significant relationship with out-of-school groups which exercise so important an influence on children's lives (Karmel, 1973, 22).

Applied to the context of school practice in general, the Karmel Report translated into the implementation of a more diverse curriculum by schools in response to their particular needs. However, it will be seen later in this chapter that, in school mathematics, it was not so much a new curriculum but a new pedagogy which occurred. A largely traditional curriculum content was transformed, in many, but not

all schools, by a radical pedagogy which avidly pursued the goal of individualism. This new pedagogy, usually referred to as Mastery Learning, became particularly significant in the first four secondary years of schooling throughout the 1970s.

Creating an appropriate learning environment for each individual implied a consideration of the environment of ethnic minority students. In 1973, the Federal Minister for Immigration, A.J. Grassby, issued a paper entitled, *A Multicultural Society for the Future*. Henceforth 'migrant education' was to endeavour to become 'multicultural education.' (Grassby, 1973)

In 1975 however, the Federal Government *Inquiry into Schools of High Migrant Density* showed that these schools in NSW and Victoria had made disappointing progress. Very little concession had been made to the particular need and backgrounds of ethnic minority students. Connell described some educational deficiencies in schools:

.....library sources were weak, teachers ill-prepared to deal with migrant children and even inclined to be intolerant towards them; there was severe reading retardation of both migrant and non-migrant children; and there was little communication between the schools and the migrant community or local employers (Connell, 1993, 463).

The Federal government reacted to his adverse report and the outcome was a commitment on the part of macro educators to the ideals of 'multiculturalism', a term not yet officially defined. Teachers were still working in an assimilationist mode and were not exploring the ethnic origins and cultures of their students, preferring to preserve an established pattern of non-discriminatory instruction. Also there appeared to have been little change in pedagogical approach in a majority of schools throughout the previous twenty years (Connell, 1993). Moreover, ethnic minority students were still regarded as problem or disadvantaged students. However, in researching Victorian government policy, management and implementation in the 1970s, the researcher found that, in fact, that there was considerable response to the Karmel Report in the mathematics teaching of the 1970s in many schools which, while it was not directed at ethnic minority mathematics students, did advocate the provision of individualised programs for students based on their backgrounds and

previous experiences. This will be discussed in more detail later in this section. At the same time the 1970s did witness the setting up of alternative religiously and culturally attuned schools by some ethnic groups despite the introduction in existing schools of 18 modern languages, examinable at HSC/Matriculation (Year 12) level, the establishment of English classes for ethnic minority communities and a doubling of Commonwealth expenditure contribution to education. In 1975, an estimated 50,000 students around Australia were enrolled in some 600 ethnic schools which had been established since 1970s and in 1980 there were approximately 1413 schools with an enrolment of 97,000 – most often associated with Greek community and Orthodox Church after-school, Italian community schools and the Jewish community's full-time day schools (Connell, 1993).

In 1977, the Federal Curriculum Development Centre announced that it had made multicultural education one of its priority areas for the following triennium. Its program referred to three educational requirements of a multicultural society:

- (i) the rights of ethnic groups to maintain and foster their ethnic languages and cultures
- (ii) the need for all Australians to promote cultural interaction
- (iii) the task of developing and sustaining core values and understanding in a pluralist society.

Also in 1977, the recently established Australian Ethnic Affairs Council advising the Minister for Immigration on the integration of migrants into Australian society, produced a paper *Australia as a Multicultural Society* – it suggested that there were four things needed in education:

- the improvement of language programs by a substantial increase in part-time and full-time courses for adults and increased financial aid for migrants who attend them, a review of theories and methods of teaching English as a second language, more community language courses in schools both for students of English speaking background and for non-English speakers;
- the development of ethnic studies programs in schools to 'infuse the curriculum in general with the reality of the pluralist nature of Australian society with the view of enhancing the self-esteem of students of ethnic origin and giving all children a

more authentic view of the nature of the society than the present 'monocultural education provides' – multiculturalism was not just the preservation of folk art and pretty ethnic traditions with language and literature sometimes included – this was degrading and dehumanising (Connell, 1986, 466);

- the reform of teacher education programs and the production of educational materials to improve the schools competence in producing multicultural and multilingual programs;
- Improved facilities in vocational retraining and adult apprenticeship.

These programs and the more effective teaching of English were to be designed to raise the contribution of migrants to the growth of the Australian economy by making their skills more useable and increasing the flexibility of the workforce. In short, multiculturalism was an attempt to influence and mould Australian society as a whole through cultural and social action. In various educational programs it was expected to work through towards the achievement of three tasks:

- Preservation of significant features of the important cultures that had found their way into Australian society throughout migration;
- The integration of these cultures and their bearers into a richer cultural pattern and into a mutually responsible society;
- The improvement of the economic contribution of migrants by raising their competence in the English language and in their vocational skills (Connell, 1993, 467).

In 1978 the Government accepted the Galbally Report, a *Review of Post-Arrival Programs and Services to Migrants*. The Review Committee began its report with the statement: "We believe Australia is at a critical stage in the development of a cohesive, united multicultural nation". It recommended a substantial increase in funding increase in all aspects of child and adult migrant education, and suggested that schools should develop more rapidly their teaching of 'the various histories, cultures, languages, and attitudes of those who make up our society.

In the late 1970's unspectacular development towards multiculturalism in schools took place. As a response to the language problems of the 1960s the centrepiece

English as a Second Language was slowly converted into a wider view of migrant education. In 1978, Queensland distributed the first and most thoughtful of a series of all States systems producing guidelines alerting teachers to the significance, scope and expected orientation of their programs in the name of multiculturalism. The inference was that no one multicultural program would suit all schools, and that it was not an extra subject but an infusion into existing programs. Teachers were advised to examine their own attitudes and practices and to look at objectives, content, activities and resources in their teaching programs to infuse more multiculturalism into their work in the fields of mathematics, language arts, art, social studies, physical education and music. They should also carefully study their students' experiences and knowledge and be aware of the school's policy resources and relationships with its community. Teachers were expected to build their own programs in these activities (Horwood, 1997, 123). As a result, in Victoria, VISE (Victorian Institute of Secondary Education), in which the largest contingent of representatives were teachers, devised several different mathematics courses which could be taken by students with different mathematical interests and aptitudes at years 11 and 12. All courses had some element of school assessment. The Victorian Education Department Curriculum and Research Branch consolidated its position against the control of universities and a large team of mathematics teachers was assembled to develop a framework for years P-10. Thus, as the 1980s drew closer, curriculum was beginning to experience change. Reality in mathematics education (RIME) evolved (Lowe in Horwood, 1980, 149) – the professional mathematician had been excluded from input into the curriculum for the first time by mathematics educators and the emphasis placed on mathematics by teachers related to the personal development of the student rather than to his or her education for entrance into the universities. However individualistic pedagogy which perhaps represented an evolutionary phase in this curriculum change occupied a large percentage of Victoria's mathematics classrooms. How then did mathematics teacher educators of this decade reconcile a pedagogy which needed to address the needs of the individual students with the policies and increasing directives of the government macro educators to include multiculturalism in their brief?

### 5.3.2.2 Victorian schools policy, management and implementation – the influence of mastery learning

New content and an approach which catered for a more individualistic emphasis in teaching had been inspired by the Ramsay Report of 1960. Mathematics education in Victoria of the 1960s introduced its secondary students to the concepts of New Math, derived from the work of the United States of America, the United Kingdom and the Bourbaki group in France (Clements, 1989; Moon, 1986). Individualistic pedagogy was interpreted in the period by various ability groupings such as streaming. In briefly providing an overall picture of the New Math period of mathematics education in Victoria, Clements wrote:

Children were encouraged to discover mathematical principles by means of class activities involving both inductive and deductive thinking.....This was the theory but the practice was a different matter. ....schools were simply unable to cope with the lofty ideals which were confronting them. Teachers recoiled into their shells, continuing to teach algebra and geometry whenever 'mathematics' appeared on the timetable (Clements, 1989, 49).

The plight of inexperienced teachers was not assisted by a still seriously inadequate supply of qualified teachers who also had to contend with poor physical resources and little availability of professional development. A wave of protest against New Math both at university level and in public forums in Australia on the basis of its emphasis on theoretical rather than applicable mathematics led to Australian and international rejection by the early 1970s. A need to return to skill-based and applicable mathematics was recognised by Australia's mathematics educators who now recommended 'mastery learning', a direction in mathematics which also had been developed in America. Clements described this theory as follows:

This theory was based on the premise that every student could master skills and concepts within a topic provided he or she was given enough time to do so. Norm-referenced testing, which compared and ranked students, was to be replaced by criterion-referenced testing (Clements, 1989, 50-51).

The mastery learning theory pushed pedagogical style further along the path to student individual learning, and adopted the principle that every student could successfully master the basic skills and concepts of mathematics if given enough time



to proceed at his or her own pace. The ACER (Australian Council of Educational Research), a federal body, totally subscribed to the principles of mastery learning and recommended the large scale introduction of mastery learning approaches. Ellerton and Clements wrote:

The high point of mastery learning came towards the end of the 1970s. For example, Bourke and Keeves (1977), two researchers attached to the Australian Council of Educational Research (ACER), recommended unambiguously – in a volume entitled *The Mastery of Literacy and Numeracy* – that improvement in Australian education could be effectively achieved by a large-scale introduction of mastery approaches (Ellerton and Clements, 1994, 12).

The proponents of this form of learning, which involved the definition of behavioural objectives and the setting of mastery levels, American educators, Benjamin Bloom and James Bloch in the 1970s saw their methodology spread throughout American public schools and colleges and used in a number of other countries.

A large number of textbooks, card and task systems described by such titles as “teacher-learning units” and “self-instructional modules” were purchased by Australian schools in this period. In some schools teachers wrote their own systems or modified commercial products. A planned series of steps was virtually common to them all. Gronlund described a typical example as follows:

- Name of unit (topic to be studied)
- Purpose of unit (reason for studying the topic)
- Statement of objectives (intended learning outcomes)
- Pretest (or directions for obtaining it)
- Learning activities (materials and methods for achieving the objectives)
- Self-tests (to aid student in monitoring his learning)
- Post test (or directions for obtaining it)
- Enrichment activities (learning opportunities beyond the objectives)

(Gronlund, 1974, 44).

Theoretically a student, in proceeding at his or her own pace in the classroom, could become separated from the body of the class as a whole and students could be working at a number of different points of different progress through a particular

topic within the one classroom. In the perception of the researcher, teaching in this manner in the 1970s, the role of the teacher changed from one of clear leadership which engaged the entire classroom at once to one which perhaps could be described as a human resource centre. It should be noted that while the practice of mastery learning remained in place in Government schools, in some Catholic schools and in a few Independent schools through the 1970s its adoption by schools in all three sectors was variable. Some schools paid no attention to it at all while others embarked on a full commitment. Government schools tended to be the heaviest users of mastery learning, and in fact, embarked on new buildings designed to facilitate its practice with installations of large, 'open classrooms' and library and laboratory facilities. Certainly, teaching techniques in mathematics which attempted to address the individual abilities and interests of students were a characteristic pedagogy of most schools. Variations in pedagogical approach which were experienced by the researcher who worked as a secondary mathematics teacher in the years 7 to 10 in three sectors are shown in Table 17:

**Table 17 – Three different approaches to mathematics teaching in the 1970s**

Time period	Sector	Pedagogy
1970 – 1972	Large Government metropolitan co-educational school – 10 percent ethnic minority of mainly European origin	Levels – years 7-10 Rigid streaming and teacher directed pedagogy was a continuation from the 1960s. Highest achieving Mathematics classes were tied to French, German and Music classes. A totally new course with different teachers and subjects had to be arranged for a student to unlock from placement in a particular mathematics level. Different tests were set for different levels of aptitude.
1973 – 1974	Large metropolitan co-educational Independent school – a very small Asian and European ethnic minority percentage	Levels – years 7-10 Mastery learning using a card system written cooperatively by teaching staff – student achievement reported in graphical form to parents through addition of test results assigned according to levels of Bloom's taxonomy.
1975 – 1980	Medium sized metropolitan Catholic girls' school – 50-60 percent students of diverse ethnic minority origins	Levels – years 7-10 Setting into three levels at each year level with all mathematics at each level simultaneously timetabled. Mathematics not tied to other subjects allowing for movement between levels and some withdrawal from mathematics for ESL classes. Core and extension tests.

Thus it can be seen that mathematics education of the 1970s was marked by a period of teacher/school curricular control which embraced pedagogy projected towards individual student progress and in which mastery learning played a prominent part.

### *5.3.3 Ethnic minority students in the 1970s mathematics classroom*

The largest contingent of the 1970s period of immigration of the 1970s was the combined numbers of ethnic minority immigrants who arrived from countries with some common elements of culture and educational experience. These ethnic minority students came from Vietnam, Philippines, Malaysia, Indonesia, China, Hong Kong, Taiwan, Japan and Korea (Jupp, 1998; Castles et al, 1998; Connell, 1993). Although these students came from a number of different east-Asian countries, a substantial number of them were described as 'ethnic Chinese'. They were descendants of immigrants in earlier times who came from China to countries in South-east Asia where they had formed distinct communities and had retained aspects of Chinese culture. Bullivant wrote:

Students from Asian backgrounds had a number of features in common, although there were some variations due to their countries of origin. Ethnic Chinese were from Indo-China, Timor, and Chinese generally came from such countries as Hong Kong, Singapore, and Malaysia. Many of these were second generation. There were also Vietnamese, Laotians, Cambodians and others from the Indo-China region (Bullivant, 1987, 108).

What were the responses of the macro educators to the presence of these ethnic minority students in the individualistic mastery learning scenario? Research has indicated that cultural factors play a critical role in the effective teaching and learning of mathematics. What cultural characteristics of the ethnic minority of the 1970s, so different from that of the previous decades, invited a response on the part of the macro educators? What were the connections between the basic tenets of mastery learning and its pedagogy of providing the appropriate time and standard of difficulty for each individual student and the cultural and educational characteristics the ethnic minority students brought to the classroom? An attempt will be made to align the pedagogical characteristics of mastery learning, using major points of planned steps described by Gronlund, 1974, with the pedagogical experiences these ethnic minority students brought to the mathematics classrooms of the 1970s based on descriptions

of the cultural environment of Chinese mathematical teaching and learning written by Leung (1989, 1992) and Chin (1995). The researcher's Australian teaching experience during the 1970s will be used for the description of mastery learning in the Australian classroom and some contribution to the Asian experience can also be provided through a historical study and observations of Japanese school mathematics (Wotley 1997). Some time was spent also observing Indonesian mathematics classrooms in 1991. Before proceeding with a description of mastery learning in relation to ethnic minority students, some aspects of Chinese and Chinese-influenced mathematics education throughout south east Asia will be considered. Leung categorized features of this education in categories:

- *Social orientation which was seen as the opposite to individual orientation.* Social orientation was related to attributes of obedience, compliance, respect for superiors and filial piety in a cohesive community setting. The cognitive styles connected with these attributes affected the way people learnt mathematics. Students were not encouraged to learn in any different way than the national common provision.
- *Stress on memorisation and practice.* In discussing these attributes, Leung noted the importance in Chinese education attributed to short term memory and concentration on practice through substantial amounts of homework.
- *Language characteristics.* The advantage of Chinese orthography taught to students in childhood, which was thought to be instrumental in 'visual-form discrimination or space conceptualisation'. An advantage of the Chinese language was recognised because it contains within it "essential semantic elements it uses in mathematics". The ease with which Chinese students are able to use algebra and to move between symbol and language perhaps can be attributed to the fact that pronumerals (in English) are not recognizable to them as abbreviations of words in their own language.
- *The high parental expectations of the Chinese.* The attributing of children's success or failure to controllable factors. Within these attitudes, feedback/

reactions were seen as inducements to put in more effort. There was an expectation that teaching content would be demanding (Leung, 1989).

Leung noted the lack of rigorous evidence of these findings in research but remarked:

It is difficult to establish causal relationship between culture and other variables, for culture is so all-embracing that it is practically not possible to "control" for culture. Nevertheless, I hope I have argued that there are sufficient findings of different mathematical learning behaviours among students from different cultures that suggest culture does make a difference (Leung, 1989, 130).

Differences between the mastery learning classroom and the Chinese classroom are summarised in Table 18:

**Table 18 – Mastery learning in different cultures**

Planned teaching and learning steps in mathematics education. Years 7-10 (Gronlund, 1974)	Mastery Learning years 7-10 - teaching and learning techniques in mathematics Experienced by the researcher teaching in the 1970s	Years 7-10. Some East-Asian - Pacific teaching and learning techniques (Chin 1995; Leung (1989, 1992; Wotley 1997)
Introduction of a new topic Purpose of the unit Statement of objectives (intended learning outcomes) Pre-test	<p><u>Teacher activity</u> - Correction of previous topic Post-test. If Post test revealed 85-90% correct result, student was introduced to next topic, pretested and issued with a new set of new topic cards. Teacher was involved in marking, recording and reporting on pre and post test results, recording issues of cards and answering individual questions from students in difficulty who arrived individually at the teacher's desk.</p> <p><u>Student activity</u>: Reading about the purpose of the unit, statement of behavioural objectives and completion of Pre-test. Students after issue of cards for the topic were able to go to the teacher for help.</p>	<p><u>Teacher activity</u>: A tradition of in-depth teacher - directed exploration and discussion and examination of different approaches undertaken simultaneously by the whole class, before proceeding with exercises and problems of each new topic. This stage of learning could occupy several days and was highly researched and planned by the teacher. Teacher worked at the front of the class using either instruction through monologue or question and answer with students. Puzzles and other physical resources were directed to the class to consolidate understanding of new ideas.</p> <p><u>Student Activity</u>: All students participated in a variety of teacher directed exercises.</p>

<p>Learning activities of the topic</p> <p>Self-tests to allow student to monitor progress.</p>	<p><u>Teacher activity -</u></p> <p>Teachers answered individual student queries about different problems. During class, issuing, correcting pre and post test results were required. Reporting and recording individual test results and feedback to individual students followed.</p> <p><u>Student activity was an</u></p> <p>exercise in reading and following out instructions .</p> <p>Students proceeded through cards which contained examples and practical exercises. Self tests allowed them to monitor their own progress. As the teacher was involved with other students all at different stages of completion, self-motivation was important. Distractions could be a problem. There was often movement in the class as students crossed the floor to work with others at the same stage. Students were usually but not always, permitted to take cards home.</p>	<p><u>Teacher Activity</u></p> <p>Teacher directed a system of collective problem solving by calling groups of students to the board to work out solutions one by one with the rest of the class commenting, advising and assisting the students at the board. Drill questions were then completed from texts and work sheets. Homework was set.</p> <p>Teacher at all times was the director of activities and remained in place at the front of the class. Individual questioning directed to the teacher in front of the class by students did not often occur.</p> <p><u>Student activity</u></p> <p>Students participated in board work as above and proceeded with drill examples in class and at home.</p>
<p>Post-testing and Reporting</p> <p>Enrichment activities.</p>	<p><u>Teacher Activity:</u></p> <p>Post tests were used to assess students. In some cases these tests were assigned marks according to categorisation of questions on the basis of Blooms Taxonomy. Many test reports to parents were criteria referenced. In some cases enrichment activities of students were reported in comment form.</p> <p><u>Student activity:</u></p> <p>Until year 10 test results generally were not the result of formal examination However formal testing often began at the end of year 10 prior to preparation for HSC examinations in years 11 and 12. The results of these examinations revealed a huge spread of mathematical understanding.</p>	<p><u>Teacher activity:</u></p> <p>Norm referenced results were of great importance in terms of academic and career directions in later years. Teachers emphasised the importance of examination results and exerted pressure on students to perform at high levels in formal examinations.</p> <p><u>Student activity:</u></p> <p>Parents exerted pressure on students to achieve high results. Coaching institutions were used to enhance student results. Students were highly competitive in exams because of entrance requirements of future institutions and career paths.</p>

Although the mathematical experience of the predominant ethnic minority in the 1970s differed greatly from the widely used mastery learning teaching methodology and, despite the growing government rhetoric on the need for multiculturalist approaches in education, evidence is lacking of **any intervention by the macro educators on behalf of the ethnic minority in mastery learning or of any interest or interchange of ideas**. However this lack of attention may not have disadvantaged the ethnic minority mathematics students of the 1970s. Despite their previous experience in relatively large classes mastery learning provided a certain freedom through lack of teacher intervention. Ethnic minority students could work alone and undisturbed or in small groups working at the same speed. Also mastery learning required the ability to read in English but not necessarily the need to speak, especially in the embarrassing and unfamiliar context of a whole class listening in. A difficulty in understanding could be addressed privately to the teacher on a one-to-one basis. Many of the ethnic minority students could read in English (some because of a colonial past) reasonably well but were unable to communicate verbally. There was ample opportunity to work collaboratively in class, particularly in metropolitan areas, with people of the same nationality and level of understanding, even in the use of a language other than English. Self-motivation was an essential student attribute and these students were steeped in this tradition which was echoed in the attitudes of their parents. Left to their own devices there was no problem in the use of their own languages, some of which are easier to convert to algorithms than English, such as Mandarin. Constant feedback on their progress was a familiar part of their education and this was a guiding principle of mastery learning.

A clear disadvantage to all students, however, was noted by Clements who described the impoverished language skills in English with which they emerged from their mastery learning years and this proved to be a difficulty in understanding the more wordy problems and projects of prescribed year 11 and year 12 mathematics (Clements, 1989). The end of mastery learning came by the early 1980s. Clements described some of the difficulties with its practice encountered by Australian mathematics teachers as follows:

At the classroom level teachers found the task of organising materials for students for so-called 'individualised' lessons was an extremely arduous one. They had virtually no training or experience in gathering materials which would

meet the needs of the thirty or so individuals in their classes, and they found daunting the extent of the paper work associated with assessment procedures. Also, not only did parents fail to appreciate the idea of criterion-referenced testing but often wanted to know how well their children were doing in comparison with other children. In addition, individualised classrooms came to be associated with impoverished language development (especially the language of mathematics) (Clements, 1989, 51).

Severe criticisms had been levelled at the practical application of mastery learning in the classroom by Erlwanger (1975) and the research which provided its justification was criticised by Freudenthal (1979). Mastery learning around the world became discredited (Clements, 1989). It will be seen in Chapter 5, some remnants survived in the use of Goodger mathematics at primary level and in the criterion-referenced teaching retained in some senior studies by the Victorian Ministry of Education in later years.

#### *5.3.4 Response to the ethnic minority population of the 1970s – a summary*

- In the later years of the 1970s multiculturalism began to enter the policy documents and management strategies of the macro educators primarily as a result of the recommendations of the Galbally Report. Its findings resulted in funds for ethnic minority education.
- Full-time schools were established by various ethnic minority communities which emphasized cultural and religious values while providing academic education.
- Mastery learning in mathematics education, was endorsed by the macro educators and represented indirectly responses to some ethnic minority values, but not to all. The largest group of ethnic minority students came from East and South-East Asia. Their industrious study habits, the ability to read English, and preference for non-participatory class activities represented an advantage. A disadvantage, however was the need in mathematics to write and participate discussively in English particularly for the prescriptive mathematics of the last two years of secondary school.



### 5.3.5 *Links with the next decade*

Throughout the post-war decades 1950s to 1970s, the content of mathematics curriculum had remained relatively unchanged despite the onslaught of increased numbers of students, the arrival of large numbers of immigrants many of whom did not speak English and a change to individualistic pedagogy education endorsed by macro educators, but largely shaped and administered by teaching practitioners. In the 1980s it was the curriculum which occupied the interests of the mathematics macroeducators and with it came official government recognition and control of policies for action with respect to the multicultural nature of classroom populations. What then was the relationship between curriculum change in mathematics education and the directives of government to recognize and include cultural difference in education. Multicultural education in the late 1970s, as seen in this section, was the subject of much government activity in the form of reports and recommendation such as the Galbally Report (Galbally, 1978). How did the mathematics macro educators respond to the increasingly diverse nature of immigration and the need to produce a multicultural form of mathematics curriculum? In the 1980s, policy and the management of its recommendations seemed to be conflicting.

### 5.4 **The 1980s -- Ethnic diversity, mathematics education and a multicultural curriculum**

In the final years of the 1970s the term "multiculturalism", if not yet the practical manifestation, had entered the education world. F. E. Galbally, foundation Chairman of the federally appointed Australian Institute of Multicultural Affairs which released the Galbally Report, in 1978 wrote:

If we look back at the 1970s, we can see that there have been impressive strides forward in pursuit of the multicultural society. Politicians, political parties, governments of all shades have adopted multiculturalism as policy with surprising rapidity.....In education there has been a reassessment and reshaping of the old adult migrant education services. The Commonwealth has funded the development of multicultural and migrant education programmes in schools - extending well beyond the government school sector (Galbally in Burnley et al, 1985, 114).

However, despite the plethora of multiculturalist rhetoric, reports and policy statements, evidence of any impact through policy and action on the part of the macro mathematics educators in the late 1970s was difficult to identify within the constructs of mastery learning, a pedagogical technique largely embraced by mathematics teacher and school organisations of Victoria in this decade. Any consideration of disadvantage or advantage in the ethnic minority in the mathematics classroom, seemed to owe more to unstructured culturally-related factors than to specific management strategies.

Conversely, in the 1980s, there was evidence that multiculturalism secured a place in the curricula of Australian schools and that this was at the instigation of the macro educators at a policy level. What were the patterns of immigration in the 1980s? What management strategies and implementations were directed by mathematics macro educators of the time to ethnic minority students of the 1980s in the name of multiculturalism?

#### *5.4.1 Characteristics of immigration policy and practice in the 1980s*

A comparison of population figures of the 1970s and 1980s revealed a relatively small increase in the number of overseas settlers: Of Australia's total population, 20.2% in 1971 and 20.8% in 1986 were born overseas. However a comparison of birth-place percentages does show some significant changes. The proportions of immigrants arriving from regions all over the world had changed. As noted in Chapter 3, country of birth statistics do not always provide a true picture of particular cultural and ethnic groups and a more authentic picture can be gained from the work of the ethnographer, Charles Price who employed a number of cultural factors in his definition (refer Chapter 3). For the purposes of comparison in the next section, however, Census figures assigning regions of birthplaces are provided in Table 19 from Jupp (1998).

**Table 19 – Some population statistics**

Birth Place	1971 (%)	1986 (%)		Change in %
UK and Ireland	42.19	34.71	↓	-7.48
Southern Europe - Italy, Greece, Yugoslavia, Malta, Cyprus	25.95	20.63	↓	-5.3.2
Rest of Europe	17.53	13.8	↓	-3.73
North America - Canada, US only	1.66	1.93	↑	1.93
Oceania - mainly New Zealand	3.80	8.14	↑	4.34
Latin America	0.50	1.65	↑	1.15
Africa-includes South Africa but excludes Egypt	1.31	2.40	↑	2.40
South Asia - India, Sri Lanka and Afghanistan	1.55	2.60	↑	1.05
East Asia - China, Hong Kong, Taiwan, Japan and Korea	1.09	2.72	↑	1.63
South East Asia- Vietnam, Philippines, Malaysia and Indonesia	1.49	7.4	↑	5.95
Middle East - Egypt, Lebanon, Turkey, Iran	1.72	4.00	↑	3.28

Actual numbers have been taken from Jupp, 1998, 193. Sources are based on definitions of Bureau of Immigration Research: *Immigration Update*, September 1990, AGPS, Canberra, 1990

The largest percentage rise came from South East Asia with significant rises in the numbers of immigrants coming from the Middle East and New Zealand. It can be seen that the largest proportion of immigrants living in Australia still came from Europe but that these percentages were falling, on the average, at a faster rate than the rate of increase of immigrants from non-European countries living in Australia, with the exception of New Zealand. It should be noted that immigrants from New Zealand came from communities with one of two different ethnic backgrounds – the English speaking Anglo-Celtic community and the Maori communities. The latter, while English speaking, remained attached to the values of their Maori tribal cultures.

A chronology of the major immigration policies and events of the 1980s appears in Table 20.

**Table 20 – Immigration policies and events of the 1980s**

1980s	Immigration Policies and Events
	1980 – Most Good Neighbour Councils disbanded after withdrawal of funding
	1981 – Assisted passages to end except for refugees. Population figures: Aboriginal - 159 897 - 1.1% Native born settlers - 11 382 716 - 78.1% O/S born settlers - 3 033 717 - 20.8%
	1983 – Distinctions between 'British' and 'aliens' ended
	1984 – Start of Blainey debate on Asian immigration
	1986 – Review of Migrant and Multicultural Programs and Services tabled in federal parliament. Population figures: Aboriginals - 227 645 - 1.5% Native born settlers - 12 127 130 - 77.7% O/S born settlers - 3 247 381 - 20.8%
	1987 – Office of Multicultural Affairs established
	1988 – Fitzgerald Report on immigration policy
	1989 – Bureau of Immigration Research established in Melbourne and the <i>National Agenda for a Multicultural Australia</i> is published

Jupp 1998

#### 5.4.2 Macro policy and administration of multicultural education

One of the results of the immigration patterns of the 1980s was an increasing diversity in Australia's school populations and a response to this diversity in a number of government papers, in spirit aimed at multiculturalism, and emanating from both State and Federal macro educators. The diversity of Victoria's school children was quantified in such a paper entitled *Education in, and for, a Multicultural Victoria: Policy guidelines for School Communities, produced by the Ministerial Advisory Committee on Multicultural and Migrant Education (MACMME)*, published by the Curriculum Branch, and issued to all schools by the Ministry of Education, Victoria, 1986. This paper included the following commentary:

The diversity of contemporary Australia is apparent in Victoria and Victorian schools, perhaps more than in any other state. The following statistics clearly illustrate this point

- The 1981 Census showed that more than 800 000 Victorians were born overseas. This number constituted almost 23 percent of the total population.

- The same census showed that 15 per cent of the Victorian population came from non-English speaking countries.....
- In 1985, nearly 140,000 students (almost 25 percent of the total enrolment) were born overseas in a non-English speaking country, or were born in Australia and had one or both parents born overseas in a non-English speaking country (the latter are usually described as being of non-English speaking background (NESB).
- In 1983, more than 65,000 students in Catholic schools (almost 40 percent of the student population) were of non-English speaking background.
- Between them, these Victorian school students and their families speak more than fifty languages other than English.(Ministry of Education, Victoria, 1986, 5).

This account of diversity within the ranks of Victoria's school children appeared after the publication by the Victorian Minister of Education, Robert Fordham, of a number of papers which outlined the educational philosophy of the then, newly-elected Victorian Labor Government. An earlier report, which will be discussed in more detail later, was the Ministerial Paper No. 6 (1984), entitled *Curriculum Development and Planning in Victoria*. This paper made a significant impact on schools.

It should be noted that a further source of diversity in Victoria's school population was the 2500 Aboriginal children in schools throughout the state. These students are not the subject of investigation in this thesis but are noted here because of their contribution to the diverse nature of Victoria's student population.

Within the report "Curriculum for a Multicultural Victoria" twelve points, some of which referred to Ministerial Paper No. 6, were outlined. The concluding point noted:

A curriculum that is truly inclusive acknowledges and uses past learning experiences. It also acknowledges that these experiences will differ for individuals and groups of students. Curricula should demonstrate respect for what students bring to the school with them. The content of curricula, the material used and the teaching and learning methods should reflect the presence, the experiences and the perspectives of groups that have usually been excluded

in the past.....An inclusive curriculum is multicultural in nature (Ministry of Education, 1986, 9).

Ministerial Paper No. 6 contained within its guidelines a broad description of curriculum as not only the source of content, but also the source of assessment policy, staffing and facilities, all underpinned by a set of values, which in a diverse society, represented some sort of common and acceptable thread. The responsibility of providing a suitable curriculum lay with the schools themselves through decisions of their own school councils. The paper states that:

Schools should seek to identify these common values as a basis for educational policy and to find ways of reconciling differences where values conflict. In formulating these guidelines, the government has drawn upon values which it believes are widely supported (Minister of Education, 1984, 8).

Generalized pedagogical approaches were outlined but there was some specification of subject areas. Within these recommended pedagogical approaches there was some reference to cultural influences. In a section headed *Relate learning to action* the following statement was made:

Schools should be aware of the influence of gender, class and ethnic background on styles of learning and take account of these factors when planning their approaches to teaching and learning (Minister of Education, 1984, 16).

Within specified *areas of learning* the requirements of mathematics were described in the following terms:

Each school council should ensure that its program enables students progressively to:

- Understand and apply basic concepts of number, quantity and space and to understand logical and quantitative relationships and patterns; and
- Employ mathematical concepts and processes in a variety of situations including those in the world outside the school (Minister of Education, 1986, 17).

As a result of this paper the Ministry of Education (Schools division), Victoria published a series of Curriculum Frameworks which were issued to all schools in

Victoria throughout the year 1988. These publications contained detailed curriculum guidelines for the teaching of students from preparatory grade (P) to year 10 (10), designated P-10. In the words of the introduction of the book entitled *The School Curriculum and Organisation Framework P-12*, a stated intention was:

.....to help school communities plan, develop and implement a curriculum that meets the needs of all students and that of the society in which they live (Ministry of Education, 1988, 7).

The issue of this series was consultative and all schools prior to publication were able to participate in reviews and discussions. The extent of the use of these Frameworks by schools in the last years of the 1980s was optional.

#### 5.4.3 *Significant change in mathematics curriculum policy in the 1980s*

In the frameworks publication concerning mathematics, entitled *The Mathematics Framework P-10*, change in mathematics practice was emphasized

This document offers a view of changing mathematics practice which will progressively evolve into the 1990s. It is primarily a guide for teachers, emphasising changing teaching and learning methods within the classroom. It suggests an approach to curriculum development and planning which is linked to classroom change (Ministry of Education, 1988, preface)

The changes referred to above which needed to be addressed in current mathematics curriculum practice were illustrated diagrammatically and were followed up by guidelines in subsequent sections. This diagram depicted the connections which needed to be made of current practice with technology, problem solving, gender equity, applications, cooperative group work, language learning and access/success (The Mathematics Framework P-10, 1988, 15).

Current practice was shown thus to have significant shortfalls. The need for change in this document involved a clear perception of the disadvantaged position of girls in mathematics learning. The need for technology was not an unexpected required change and in a discussion of the 1990s it will be seen that technological change had a continuing and increasing effect on mathematics teaching and learning. The language learning referred to in this diagram was the use of language in mathematics

and not the general use of English. The diagram therefore made no reference to the extraordinary and unprecedented change to the environment of mathematics classes, namely the numerically significant and immensely diverse presence of ethnic minority students who brought with them a variety of culturally related mathematical practices. One of the changes however did register an American derived philosophy in the mathematics teaching and learning, already in practice in the earlier 1980s. The introduction of problem solving in school mathematics was a change which seemed to permeate the thinking of the macro educators of the 1980s. Clements, describing the progress of problem solving after the Australian Association of Mathematics Teachers (AAMT) conference in 1982 where a large number of papers were presented on the subject, wrote:

This rapid growth (begun in the late 1970s) in interest in problem solving at the beginning of the 1980s followed upon the appearance, early in 1980, of a booklet, *An Agenda for Action*, produced by the National Council of Teachers (NCTM) in the United States of America. Altogether, eight recommendations were made, and the first of these stated, simply that problem solving should be the focus of school mathematics in the 1980s (Clements, 1989, 52).

In the next section problem solving in mathematics teaching and learning will be examined in more detail as a significant component of mathematics education in the 1980s.

#### *5.4.4 Problem solving in mathematics curriculum policy of the 1980s*

The frameworks document relating to mathematics saw problem-solving techniques as applicable to all school levels of mathematics learning. Problem solving was prescribed in the course descriptions of mathematics of the VCE (Victorian Certificate of Education years 11 and 12) and in the form of a CAT (Common Assessment Task) and its techniques had been prescribed in the preceding HSC (Higher School Certificate) in the form of an "Option". The Curriculum Frameworks was unambiguous in noting the connection between education in P-10 years to the VCE years as shown by the following statement:

Curriculum Frameworks and the Victorian Certificate of Education share a common heritage. Both have resulted from developments which have been the subject of debate and discussion for many years. Ministerial Paper 6,



Curriculum Development and Planning in Victoria, has strongly influenced the directions of the two. Because there is strong consistency between the two developments, Frameworks represent an important resource for post-primary schools as they plan for the introduction of the VCE (Ministry of Education, 1989, 2).

The stages in the problem-solving approach applied as a general approach to all problems. The mathematics Frameworks document described variation in "real-life problem-solving". Problems it contended could be:

.....large or small, long range or short range, well-defined and specific or general and partly defined and may have one correct answer or an optimal solution (Ministry of Education, 1988, 47).

A four-stage strategy exemplified in the document included the following four steps: Understanding the problem, devising a plan, carrying out the plan and looking back.

These four stages, in more detail, are reproduced below:

1. *See*  
*What is the problem?*  
*What are we trying to find out?*  
*Can we restate the problem?*  
*Can we simplify the problem and still come up with a reasonable answer?*
  2. *Plan*  
*What do we know?*  
*What do we need to solve the problem?*  
*What do we need to solve the problem?*  
*Do we need more information?*  
*How do we get this?*
  3. *Do*  
*Carry out the plan*
  4. *Check*  
*Compare our solution with the original problem.*  
*Does it make sense?*  
*Should we revise our plan to meet all the conditions?*
- (Polya, 1953 in Ministry of Education, 1988, 46)

Finally, in the assessment of problem-solving exercises, strategies included assessments of satisfactory completion of each critical stage, involvement of parents

in homework and thereby in assessment, assessment of extension work and self-assessment techniques. To the large group of ethnic minority students arriving from Asia, this scenario was a very unfamiliar one. Teacher perceptions of response will be investigated in Chapter 6. In the 1970s some of the characteristics of Chinese mathematics education were illustrated: there seems to be no question that speaking English was a problem and from the 1960s onwards ESL classes and later community language teaching were instigated in schools. But that there were also cultural differences in the experience of these students was also revealed. To what extent did the macro educators recognise and address these cultural differences in mathematics?

#### *5.4.5 Macro response to the ethnic minority population in the 1980s – a summary*

The use of Frameworks publications in Victorian schools was not a compulsory requirement in the 1980s, but the publicity surrounding them, the participation of teachers in their preparation and the supplies of documents supplied to all schools meant that the great majority of teachers had read them. Most schools would have used them, at least for reference purposes. Siemon in comparing the New Math movement of the 1960s to the problem-solving, of the 1980s wrote:

In both cases, what was laudable in its own right, was latched onto, processed, packaged and marketed with such ferocity that the very features that offered the best hope for long term and meaningful change were lost or never recognised in the burgeoning literature (Siemon 1986, in Clements, 1989, 52).

In the experience of the researcher the emphasis on problem-solving was seen as a positive step by practising teachers for a number of reasons, which the move away from abstraction in mathematics and the creativity and motivation generated when students became more responsible for their own progress within a framework of teacher consultation. Another compelling reason appeared to lie, however, in the inclusion of problem-solving requirements in the VCE and the need for practice before year 11 and 12 years were reached. This, in turn was related to the achievement of scores required for entrance into the various tertiary courses of choice. Within this perception there appeared a faint echo of the domination by university requirements of school mathematics prior to the 1960s which produced an elitism and consigned a 'gatekeeper' mentality to its study. Thus, problem-solving in mathematics attained a high level of credence in all Victorian sectors. Other changes

in curriculum such as the Cockcroft Report on school mathematics in the United Kingdom published in 1982, which promised to be influential at that time, were subsumed by the later influences of the Frameworks documents. The Cockcroft Report came under the Australian criticism that it did not pay attention to the social environment in its implementation (Clements, 1989). Problem-solving, which was seen to fulfil the desire for the kind of education which was appropriate for all children, therefore became a necessary, if unfamiliar task, which ethnic minority students had to accommodate in their mathematics learning. Was this then an implicit response of the macro educators to the mathematics education of the ethnic minority despite a lack of overt reference to multiculturalism, in the Frameworks documents? What was the Victorian destination of the Report of Ministry of Education, Victoria, of 1986, entitled *Education in, and for, a Multicultural Victoria*, published two years after Ministerial Paper 6? Had statements such as the following been ignored?

In a paper issued by the Victorian Director General of Education in 1979 the prescriptive generalizations appeared which, to a large extent, were connected with language. In Discussion Paper, Number 2, presented by Falk for NACCME in 1985 these prescriptive generalizations were listed and described as 'not linked together as causally related'. One of these prescriptive generalizations read:

Schools and administrators need to develop programs that will reinforce the contribution made to Australian society by the migrants who have come to settle here (Falk, 1985, 20).

This question remains unanswered. Certainly there was a large collection of events and policies of the 1980s into the 1990s related directly and indirectly to mathematics education reveal the following contradictory factors:

- It was seen in Chapter 3 that world-wide mathematics education research had connected effective mathematics teaching and learning with the need for recognition and understanding of its cultural setting from such writers as Faseh (1982), d'Ambrosio (1985), Bishop (1988)
- Chapter 2 described the arrival of a fallibist position in the philosophy of mathematics education which enhanced support for a social, cultural and political approach (Ernest 1991).

- Chapter 5 has described a federally-based Australian macro educator stance on the necessity of addressing multicultural education in documents such as Galbally Report (1978) and the Ministry of Education of 1986.
- The selective nature and changing patterns of federal immigration policy has generally underpinned this thesis. The recruitment, in the 1980s from the highly technological and business oriented countries of South East Asia and the resulting diversity of student ethnic origins have been described by writers such as Jupp (1998), Castles et al (1998), Hugo and Maher (1991).
- In the 1980s, a Victorian State policy and management introduced structures of curriculum, which provided generalised guidelines in all areas, which could be adapted to all school environments. In mathematics change to curriculum included an emphasis on problem solving which was applied at all year levels of schooling and which was planned in close association with practising teacher representatives (Frameworks documents, Ministry of Education, Victoria).
- A selective federal immigration policy which actively sought immigrants in the 1980s from the highly technological and business oriented countries of South East Asia described by such writers as Jupp (1980, Castles et al (1998) and Hugo and Maher (1991).
- A dichotomy between Victorian state policy which espoused the cause of multiculturalism and a Victorian state management which took a generalist stance in mathematics curriculum through an emphasis on problem solving in mathematics education applied at all levels of schooling (Documents relating to Frameworks, Ministry of Education, Victoria).

One could speculate that philosophical change in attitudes to mathematics, new research which revealed cultural links with mathematics education, the interweaving into society of multicultural interaction recommended in the Galbally Report (Galbally, 1978) and the generalised approach of the mathematics Frameworks document with its emphasis on new curriculum, required superior strategies for communication and interchange between the parties concerned. There were many facets and areas of possible conflict needing resolution for a clear direction of response to be implemented by the macro educators of the 1980s to the needs and contributions of a diverse ethnic minority students in mathematics education.

The mathematics framework was to provide guidelines for all schools including those with significant numbers of ethnic minority students. What contribution could these students have made to the mathematics classroom? In the investigation of the 1970s of this chapter, attributes of one of the largest minority groups in Australia, namely, Southeast ethnically Chinese students, it was seen that their previous education had at its base careful, teacher based introduction to new topics, skill-based exercises, high motivation reinforced by teachers and families who constantly kept account of student progress, a belief that all students could succeed if enough effort was expended and a strong valuing of further and tertiary education (Leung, 1989). By the late 1980s the superior and advanced mathematics skills, but as will be seen later, not necessarily the problem-solving abilities, of these students had become obvious. The superiority of many Asian students in basic mathematics skills, was a matter of concern to the government macro educators. In the United States concern was expressed about the inferior skills of "American" school students and in Chapter 2 the finding of experimentation by researchers such as (Stigler and Perry, 1990) who introduced some American students to aspects of Japanese education was described. The macro educators of Australia became concerned about the levels of numeracy within schools. To address this concern compulsory and continuous testing was introduced, a major character of this testing being continuous feedback to teachers, parents and schools. Literacy was also a concern of the macro educators and so an aspect of government control was imposed on the two most valued educational disciplines in schools. Did these numeracy and literacy concerns of the macro educators side-step the innovative problem-solving and the evolution of mathematical educational change of the 1980s? In Victoria, problem solving had owed its design and implementation to collaboration between teacher practitioners and state macro educators. Could the imposition of the compulsory Curriculum and Standards Framework in the 1990s and prescribed national testing in mathematics be construed as an indirect response of the mathematics macro educators to the presence of ethnic minority students and the traditions of numeracy learning of the mathematics education in their home countries?

It should be noted that the 1990s decade saw the growth of use of technology in schools and it became a major issue in mathematics education. Its importance in both

the research and practice of mathematics education of the 1990s has steadily grown throughout the 1990s and continues to do so into the twenty-first century. However, as this thesis was begun and the data collected up to the middle years of the 1990s, curriculum and assessment of mathematics will form the basis of discussion which will concern the first part of the decade in the next section.

### **5.5 The 1990s – A concern with numeracy. An indirect response to ethnic minority enculturation?**

In 1992-1993 unemployment figures in Australia peaked at 10.7% in what was described by the then Prime Minister, P. Keating as “the recession Australia had to have”

The down turn of employment in the late 1980s coincided with “economic rationalism” which had become part of new thinking in the policy of Federal Immigration of the early 1990s. According to Jupp, two factors changed the nature of immigration in the 1990s. The first was that the acceptance of unskilled, non-English speaking immigrants represented an unacceptable cost to the nation. The second was that the manufacturing industry was undergoing a reduction of its labour force (Jupp, 1998). The Fitzgerald Report of 1988 contained some controversial recommendations. Jupp commented on this report called Immigration: Commitment to Australia, as follows:

The most controversial parts of the report express doubt about multiculturalism and urge acceptance of Australian attitudes and behaviour in terms that are sometimes reminiscent of the 1950s (Jupp, 1998, 162).

One hundred and fifty thousand immigrants could be accepted per annum based on population growth and decline factors. These immigrants, apart from those accepted on humanitarian grounds, should possess skills and business expertise, and should have relatively high education or a knowledge of a “major trading language”. Immigration should be shaped by Australia’s relations with the nations of the Pacific Rim and should not be based on ethnic or racial origins. The Galbally Report had recognised the problem of non-English speaking immigrants in 1978, had introduced the terminology English as a Second Language and had recommended finance to redress the disadvantage of lack of English skills. Conversely, in Chapter 1 there was also statistical evidence which indicated that ethnic minority students had a better record of academic performance than native-born and British-born children

However in the 1990s, English or a trading language, not necessarily linked to an English-speaking country of birth, was deemed a point scoring advantage in gaining acceptance as an immigrant in Australia. In an economically rational environment such immigrants required less expensive public funding (Jupp, 1998).

### 5.5.1 *Immigration patterns and policies of the 1990s*

**Table 21 – Immigration policies and events of the 1990s**

<b>1990s</b>	<b>Immigration Policies and Events</b>
	1995 - Global Cultural Diversity conference held in Sydney
	1996 - Office of Multicultural Affairs, and the Bureau of Immigration, Multicultural and Population Research were abolished
	Census Population of Australia
	Aboriginal 352 970 2.0%
	Native born settlers 13 491 651 75.4%
	Overseas born settlers 4 047 802 22.6%
	Total Australian Population 17 892 423 100.0%
	1997 - One Nation Party founded to oppose multiculturalism, Asian immigration and Aboriginal land claims.

Jupp 1998

A comparison of population figures showed a continuation of the trends of the 1980s into the 1990s but in the latter, a more substantial reduction in European and North American settlers as shown in Table 22:

**Table 22 – Population statistics of the 1990s**

Birth Place	1986 (%)	1996 (%)		Change in %
UK and Ireland	34.71	27.77	↓	-6.94
Southern Europe - Italy, Greece, Yugoslavia, Malta, Cyprus	20.63	15.91	↓	-4.72
Rest of Europe	13.8	11.08	↓	-2.72
North America - Canada, US only	1.93	1.85	↓	-0.08
Oceania - mainly New Zealand	8.14	9.34	↑	1.20
Latin America	1.65	1.87	↑	0.22
Africa-includes South Africa but excludes Egypt	2.40	2.65	↑	0.25
South Asia - India, Sri Lanka and Afghanistan	2.60	3.59	↑	0.99
East Asia - China, Hong Kong, Taiwan, Japan and Korea	2.72	6.28	↑	3.56
South East Asia- Vietnam, Philippines, Malaysia and Indonesia	7.4	11.28	↑	3.88
Middle East - Egypt, Lebanon, Turkey, Iran	4.00	4.76	↑	0.76
All overseas/Australian Population		20.81		22.62

Percentages calculated from actual numbers in Jupp, 1998, 1993. Sources are based on definitions of Bureau of Immigration Research: *Immigration Update*, September 1990, AGPS, Canberra.

### 5.5.2 Diagnostic testing - macro education policy in mathematics education of the early 1990s

As this thesis was begun in the middle 1990s, general references to the most dominant theme of the early 1990s only will be investigated. Technological aspects have been dominant in mathematics education throughout the 1990s and they continue to occupy an important part in both research and practice in the 2001s. However in the late 1980s and early 1990s assessment became a major concern of the macro educators together with the question of the establishment of a National Curriculum for Australia. As the focus of investigation in this thesis is the classroom, the researcher has chosen numeracy and its assessment as an appropriate study because of their emergence from the end of the 1980s and their direct involvement on classroom practice.



Several pressures were at work on the assessment and reporting procedures of the 1980s which were described in the discussion of problem-solving in this thesis as "non-competitive" and related to stages within the problem solving process.

A national Working party on Assessing and Reporting was set up by the Australian Education Council (AEC) in 1989 because of concerns expressed by educators. Teacher assessment practice was seen as archaic and as behaviourist despite a pedagogy which involved problem solving and enquiry (Boomer, 1992). Another concern was the lack of value assigned to the assessment and reporting process despite the real interest of teachers and students in some designation of student progress. One of the problems identified by macro educators was the lack of quantification and appropriate measurements of outcomes.

Ellerton and Clements wrote:

At the systems level, curriculum guides had been strong on philosophy, inputs and processes, but weak on defining and measuring outcomes (Ellerton and Clements, 1994, 180).

From outside the education community, employers had expressed doubt about what they saw as slipping numeracy and literacy (Clements and Ellerton, 1996). By the end of the 1990s the Federal Minister of Education, D. Kemp, publicly expressed concern about falling numeracy and literacy levels and linked improvement in these to national testing throughout the compulsory years of schooling.

Parents in the 1990s demanded to know where their children stood in some type of ranking order. In an Independent School using the Frameworks (1988) documents, in which the researcher was teaching mathematics at this time, the mathematics department was obliged by the Principal and School Council to provide school-based marking schemes. These were allocated according to stages of achievement and were summarised as a final overall mark using letter grade linked to a percentage mark span on each of the four assessment and reporting occasions at the end of each term during the year. Parents were intolerant of word-filled reports in 'jargon' and ethnic minority parents on occasions required assistance in order to understand them.

From these beginnings, after passage through National Statements and Profiles, statewide curriculum and assessment was introduced by the Board of Studies in Victorian schools at primary and secondary level entitled *Curriculum and Standards Framework* (CSF). In the foreword of the mathematics framework, the contributions of National Statements and Profiles were acknowledged and the following description of the origins of CSF appeared:

The CSF is a product of an immense amount of time, energy and creativity given with great generosity by hundreds of teachers and other educators as members of the Key Learning Area Committees and Working Groups of the Board of Studies (Kelly and Ball, in CSF Mathematics, 1995, iii)

Macro educator concern, in an age of economic rationalism had revolved around Australia's reputation as an educator in an educator industry which attracted overseas buyers. This can be exemplified by the actions of non-government schools in the late 1980s and early 1990s.

The rise in unemployment which began in the last years of the 1980s variously affected the enrolments of students in the three sectors of education. Hardest hit were the Independent Schools who charged relatively high fees for their services. Many suffered significant reductions in student numbers. In the researcher's experience of teaching in an independent school of that time, active marketing by independent schools took place to redress this shortfall by enrolling "Full Fee-paying Students". Most of the recruitment for these schools took place in Hong Kong, Malaysia, Indonesia and Singapore. Students from Hong Kong and Singapore had the advantage of a reasonable understanding of English because of their colonial histories. Supplementary English classes were often arranged before formal schooling began for students whose English required upgrading. Almost invariably these students, once they were enrolled in school, were placed first in mathematics classrooms and were later gradually admitted to classes in other disciplines. Their numeracy and basic skills were considered adequate despite, a lack of English. In some cases students were placed in mathematics classes in year levels higher than those of their other classes. Up until this time Independent School student populations had come very largely from the Anglo-Celtic majority, although there

was a growing number of ethnic minority students from families settled in Australia as a result of immigration. The new cohort of mainly Asian students varied within schools and the correct balance of these students in the school populations was a delicate matter in terms of the retention of ethnic majority students. In the researcher's experience an average figure of the intake was about 5-10 per cent, with some Independent schools admitting much larger numbers. Another important marketing feature of Independent Schools was traditionally the success rate at VCE level. These new non-immigrant ethnic minority students were considered a sound investment in terms of mathematics results at VCE (year 12) level. One inference in this practice of placement of ethnic minority students directly into the mathematics classrooms was that the school authorities considered neither the language nor the culture of these students as impediments or worthy of attention in mathematics, unlike their placement in other disciplines.

### *5.5.3 Testing, numeracy and the ethnic minority population*

The proportion of Southeast and East Asian immigrants in the immigration figures continued to rise in the early 1990s. As was seen earlier in this chapter, many of these peoples could be considered as Chinese-Asian people. Examinations and tests have an ancient heritage in China. Clements and Ellerton described the idea of candidates competing with each other to win high positions in society, as

.....an inbuilt feature of Chinese society. This attitude has spread to the Asia-Pacific region with the large-scale migration of Chinese peoples across and within the region and the willingness of many non-Chinese Asian cultures to take on the educational values of the Chinese (Clements and Ellerton, 1996, 136-7).

Cheng wrote of the doors opened by the examination attitudes of Chinese based education:

For centuries, public education in China has given hope to millions of families for a better future for their younger generation. Although extremely few have fulfilled such a hope, public examinations have successfully pacified the underprivileged mass who would otherwise resort to revolutions. Public examinations have, on the other hand, also given education an extremely high status (Cheng, 1995, 8-9 in Clements and Ellerton, 1996, 137).

Public examinations therefore were familiar to many of the ethnic minority students of the 1990s, particularly as one of the entrance requirements into Australia was a relatively high educational level. Examination familiarity and 'a strong faith in pen and paper examinations, together with a Confucian heritage' as described by Clements and Ellerton (1996, 137) was thus twinned with skill-based expertise (demonstrated by the practice of the placement of Asian students, including those with language difficulties, on arrival, into mathematics classes by Independent Schools).

Did these attributes of Asian ethnic minority students make any impression on the Australian macro educators at the time? *Was the willingness of many non-Chinese Asian cultures to take on the educational values of the Chinese* as described by Ellerton and Clements, reflected in the attitudes of Australia's macro educators? Could the concentration of public numeracy testing in the 1990s be considered as a response to an awareness of numeracy and skill-based expertise and the importance attributed to public testing by the ethnic minority students? Could the attributes brought to the classroom have been thought of as a contribution brought to Australian mathematics education by ethnic minority students as extolled by the 1986 paper on multiculturalism in education (Minister of Education 1986)?

The researcher could find no documented evidence of such an Australian macro educator response. However research in America has taken place. The main research question was:

Why do Japanese children and certain children from other Asian countries outperform American children on mathematics and mathematics related tests? (Clements and Ellerton, 1986, 17).

Stigler and Baranes (1988) and Tsang (1988) have investigated this question. Both discovered differences in cultures of the classrooms of other nations. In an Australian publication of DEET (Department of Education, Employment and Training), Chuangshen et al (1993) reached similar conclusions and concluded:

The stereotype, both in East and the West, is that Asian students have fared well because they are well drilled in the basic concepts and operations of mathematics, but that they lack the ability to apply these effectively in problems

that do not rely on routines in which they have been rehearsed. This was not the case in our studies....

Asian teachers do not rely on drill and rote learning as techniques for teaching mathematics. This may have characterized teaching practices many years ago, but it is not a valid description of what happens today. What we have found is that Asian teachers apply what everyone would agree are reasonable and thoughtful approaches to presenting mathematics to young children.... Asian teachers appear to apply these approaches with greater consistency and frequency than do their Western counterparts. In doing this, they are helping to produce students who are leading the world in their achievement in mathematics (Chuangshen et al, 1993, 33, in Clements and Ellerton, 1996, 19)

The fact that the latter publication emanated from an Australian federal government department indicated that Australia also was interested in the practice of Chinese-based school mathematics. It raises the question that the presence Australia's ethnic minority students whose origins were culturally Chinese may have influenced or elicited a response from the macro educators of Australia.

The picture presented in this section of mathematics of the 1990s is incomplete and an analysis begun later in the 1990s or 2000 could reveal other important elements of mathematics education and the place of ethnic minority students within it. Certainly technological change has been a significant direction which has carried over into the twenty-first century. However, for the purposes of this thesis, the earlier years only of the 1990s have been reviewed.

#### **5.6 A summary of the five decades of macro educator response**

In order to investigate the dimensions of response of the macro educators to the ethnic minority within the mathematics classroom, a summary of their policies and management has been summarized in Table 23. Within this table two ways in which the macro mathematics educators responded have been described. Macro Responses which were directed specifically towards the mathematics education of ethnic minority have separated from macro responses which affected the mathematics education of ethnic minority students through indirect pathways. These two

directions have been linked in the table to the major characteristics of mathematics education in each of the five decades.

**Table 23 – Macro educator response to ethnic minority students in the mathematics classroom**

Aspects of macro policy and management directed towards classroom mathematics education of ethnic minority students	Aspects of policy and management which indirectly affected classroom mathematics education of the ethnic minority
<p><b>The 1950s</b> A deliberate emphasis, by the Immigration Department, in its information documents, on links with British education including mathematics education which had some familiarity for the mostly British immigrants of the decade but not for the smaller numbers of ethnic minority students.</p> <p>A lack of trained and qualified mathematics teachers. An increased number of teacher institutions which issued accredited teacher qualifications including mathematics education instigated.</p> <p>The beginnings of change of curriculum and pedagogy policy in Victoria which moved away from the teaching of students as a homogenous mass to the teaching of students as individuals.</p> <p>The persistence of large, crowded mathematics classrooms in Government and Catholic sectors, the use of inappropriate emergency accommodation and the lack of mathematics teachers which made the ideal of individual attention to student progress extremely difficult to realize.</p>	<p>Miscalculation of building needs. Immigrant students not included in the calculations of the State of Victoria which persisted into the 1960s. However large program of school building begun.</p> <p>An assimilation policy of the immigration which ignored the lack of English, the vernacular and cultural values of the smaller cohort of ethnic minority students.</p> <p>A lack of status felt by ethnic minority students particularly those from Southern European countries.</p>

### **The 1960s**

The need for better English skills of a specific nature in mathematics education.

From the beginnings in the 1960s, further development of the training of ESL teachers, and the funding of ESL departments in schools which recognised the special needs of language in mathematics. By the 1980s resources available to mathematics teachers addressed to the problems of language in mathematics of ethnic minority students.

By the 1980s, 1990s government-funded research recognised the role of culture, inherent in the language of mathematics. Government funding support for these findings provided in the case of mathematics education of indigenous people through the training of Aboriginal teachers and the delivery of mathematics education using bilingual techniques. No evidence found of similar policy and management directed to mathematics classes containing ethnic minority students.

Immigrants arrived from a wider European base. Immigration policy had broadened into the acceptance of some non-European immigrants.

Rejection of some ethnic minority communities of Australian education still in the assimilation period. Their perception that English was not necessary in their networked communities and schools were not serving their needs. Australian born ethnic minority students arrived at school with no English. Early leaving patterns of some ethnic minority students established.

The transformation of immigration policy from assimilation to integration and an acknowledgment of the presence and contributions of ethnic minority peoples in Australian society.

Commonwealth Government funding of training of teachers in English for ethnic minority students (TEFOL). However progress was very slow. At the end of the 1960s one third of ethnic minority students had persistent language problems which were restricting their progress at school. Language problems continued to be addressed in later decades.

Teacher distress in inner city schools where in some cases ethnic minority students outnumbered ethnic majority students. Increased language demands in more individualistic teaching.

The policy of employment of ethnic minority teachers to teach ethnic minority students discouraged in teacher training institutions.

### **The 1970s**

New pedagogy in mathematics. Mastery Learning – "learning at one's own pace".

The intention of mastery learning technique in mathematics was to encourage students to work according using their individual abilities to gain a better understanding of mathematical concepts. Endorsed and encouraged by the ACER. Schools response was variable – Variable implementation. Of the three sectors, Government schools implemented mastery learning to the greatest extent.

The teaching style used in mastery learning in mathematics was unfamiliar to many ethnic minority students at this time but the level of English to be read in mastery learning units of work was relatively simple in order to be suitable for all students in the class. Ethnic minority students could make good progress through working independently or in small groups, communicating in their own languages. Main requirement of English was reading. There was little necessity to speak or write original explanations in English. Industrious and competitive work habits, strong parental support and familiarity with written tests of many ethnic minority students, allowed for rapid progress in Mastery Learning. Availability of 1:1 student to teacher questioning relieved the culturally related sensitivities of some ethnic minority students in individual oral questioning and participation in front of the class.

Ethnic minority students entered their final years of mathematics with impoverished English. Word questions and projects in year 11 and 12 mathematics required good communication skills in English and the ability to produce written reports on individual projects.

A majority of immigrants arriving from East, South and South East Asia. Many were of Chinese descent or from cultures strongly influenced by Chinese traditions of education.

A new points system selection process which judged eligibility of immigrants in relation to industrial and technological expertise.

The Galbally Report (1978) recommended substantial funding for 'migrant' education.

Karmel Report (1973) which endorsed the role of schools as providers of education most suited to their particular student cohort.

A huge spread of differences in the breadth of understanding, mathematical skills and knowledge bases within the whole student cohort emerged at the end of year 10 and created teaching difficulties in the next years of schooling.

The establishment by ethnic minority organizations of full-time schools for ethnic minority students in the Independent sector, catering for 50, 000 students around Australia, and offering broad ranges of subject areas.



<p><b>The 1980s</b> Contradictory responses in policy and practice in Victoria. Government policy rhetoric which emphasized the need for inclusive multicultural education and acknowledgement of the experiences brought to the classroom by ethnic minority students and Victorian Government Frameworks documents which supported these principles in discussion of generalist education but which made no reference to them in the mathematics</p> <p>The introduction of collaborative problem solving (first used in the US) in mathematics through a combination of macro educator authorities and teacher organizations.</p> <p>The use of Frameworks in Victorian schools which included the problem solving approach in mathematics was optional but was highly publicized and attracted much attention, especially in government schools. Aspects of prescribed VCE mathematics internal examination tasks required its use.</p> <p>The problem solving mathematics curriculum related closely to ethnic majority cultural values but conflicted with some ethnic minority values and required a higher standard of English in mathematics in creative writing and discussion.</p>	<p>Proportion of non-European immigrants, mainly from S.E. Asia and E. Asia increased with larger numbers coming also from the Middle East, Africa and New Zealand.</p> <p>The recognition of multiculturalism of Australian society in the 1970s, 1980s and early 1990s. Increased federal funding for migrant education as a result. These funds were directed to perceived disadvantages of ethnic minority students.</p> <p>The Fitzgerald Report (1988) which cast some doubt on the concept of multiculturalism. Also it recommended careful selection of immigrants with business skills and who were educated or had knowledge of a major trading language, preferably English although they need not come from an English-speaking country. Such immigrants required less public funding.</p>
<p><b>The first half of the 1990s</b> A government based concern with standards in numeracy and literacy. Imposition by State Government of new Curriculum Standards Framework (CSF) of designated mathematics curriculum and ongoing diagnostic assessment.</p> <p>Government educator concerns about Australia's numeracy profile on the international scene. Imposition of compulsory Curriculum Standards Framework by Victorian State Government, in mathematics education, which designated sequential areas of study and included ongoing assessment of individual progress in each area.</p> <p>No reference to ethnic minority students or the role of culture in mathematics education within the documented rationale for CSF.</p> <p>Compulsory for all schools who, however, were required to structure its implementation.</p> <p>Question: Could government concerns over numeracy be construed as a response to the presence of ethnic minority students in the classroom because of high participation rates of ethnic minority students in the most demanding mathematics courses at year 12 level? No direct connections could be found.</p>	<p>Immigrants from diverse countries – proportion of South East Asian and East Asian immigrants still increasing at the fastest rate.</p> <p>1996 – the closing of the Office of Multicultural Affairs and the Bureau of Immigration, Multicultural and Population research (BIMPR).</p> <p>Recession in Australia created government concern about Australia's expertise in economic management.</p> <p>Government funded research into aspects of international mathematics education, particularly those of Chinese mathematics education.</p> <p>Active campaigns on the part of independent School Sector to enrol full fee-paying students from South East Asian and East Asian countries.</p>

## 5.7 Conclusion

In reviewing the results of investigation into responses of Australia's macro educators to the influx of ethnic minority students into the mathematics classrooms a number of opposing forces seemed to be at work. These included such generalist contradictions such as

- A policy of massive immigration in the 1940s and 1950s and a lack of planning for the accommodation and teaching of its children. The introduction at the same time of new curriculum initiatives and a more individualistic directions in teaching.
- An unforeseen change from an immigration policy which was directed to the settlement of Anglo-Celtic peoples to the acceptance of immigrants from European and non-European, non-English speaking countries.
- An immigration policy of assimilation, which initially ignored the needs of ethnic minority students to communicate in English or their needs in relation to their cultural heritages, which was followed, after the recognition of Australia as a multicultural nation, by a recognition of ethnic minority student disadvantage, including language disadvantage, and consequent government funding.
- The replacement of State controls of education, in collaboration with the universities in the first decades, by collaborative curriculum decision making which included considerable contribution of teacher and school sector organizations, and which in turn was replaced by Federal government controls of the 1990s.

Some aspects of immigration policy remained constant however. Although there were variations in immigration policy over the period of study, Australia's acceptance of immigrant peoples was always a response to perceived need to redress insufficiencies of Australian resources. While Australia accepted some immigrants on humanitarian grounds, it maintained one of the world's lowest profiles in this direction compared with other immigrant receivers such as Canada, USA and Scandinavian countries (Castles, 1998; Jupp, 1998). The serious intention of Australia's Immigration department was to establish a significant place for Australia among the countries of the world. Selection procedures in the first instance, although racist and exclusivist, represented a serious attempt to cause the least disruption in

Australia's society. By the 1990s, such factors as race, religion, political and cultural affinity were all subjugated to the pursuit of business expertise and good communication skills in business management. How did mathematics education in the hands of the educators recognize or accommodate the desired directions of the Immigration Policy through the children of these desirable immigrants? It has been shown that the macro mathematics educators were responsible for change in mathematics education but there were a number of contradictions in their policies and management strategies in relation to ethnic minority students. Some of these contradictions have been described as follows:

- Mathematics curriculum directions in the 1950s and 1960s, the policies of which endorsed more individual communication and a failure to react to the fact that significant numbers of ethnic minority students did not speak English, and that their experiences of communication were based on different cultural values. A state government policy of resistance to the employment of teachers or aides of ethnic minority origin who may have been able to bridge cultural and language gaps.
- The eventual funding of ESL resources but a failure to appreciate the special language needs of mathematics and a consequent lack of mathematics experience within the ranks of ESL teachers.
- The substantial influence of American educators in mathematics – America accepted the largest number of immigrants over the period but their proportion in relation to the total population was much lower than Australia's – the adoption and abandonment of a curriculum initiative originating in America 1960s, namely, Mastery Learning (1970s). The failure of mastery learning to consolidate basic skills to a reasonably high level for all students. The advantaged position of some highly motivated ethnic minority students increasingly arriving from far eastern Asian regions, but the detrimental effects on their oral and individual writing skills in English in the final years of secondary schooling.
- The multicultural policy rhetoric of the 1970s but the lack of its implementation in mathematics by State management macro educators of mathematics. The lack of reference to issues of multiculturalism in mathematics Frameworks documentation of the 1980s. The introduction of problem-solving, also initiated in America, as a major component of mathematics education in Victoria.

Problem-solving was valued by the ethnic majority but the language requirement and a cultural unfamiliarity created difficulties for ethnic minority students.

- The philosophy of individualism in classroom education but the failure to recognize, in mathematics, the individuality of ethnic minority students whose cultures and languages differed from those of the ethnic majority.
- The rhetoric of multicultural education policy which encouraged the valuing of past experience brought to the classroom by ethnic minority students but the lack of reference to this in the Mathematics Frameworks documents circulated to all Victorian schools in the years of multiculturalism.
- The construction of compulsory CSF in the 1990s designed to monitor individual progress in mathematics and initiated through political concern about numeracy.

There was a political interest in superior numeracy skills of Chinese-influenced education. However, a direct connection with the large number of ethnic minority students, many of Chinese origin or from countries influenced by Chinese culture, could not be found.

In the sequences of control of mathematics education, as can be seen in the educational structure of Victorian education of the 1980s, illustrated earlier in this chapter, the end point was the school. But there was one more implementation of control in the mathematics classroom, namely the teacher. What responses did the mathematics classroom teacher perceive and engineer within the classroom? In Chapter 6 teacher perceptions of response to ethnic minority students in the classroom will be investigated.

## Chapter 6

### *The Privacy of the Classroom*

In Chapter 5, policy and management responses to the arrival of ethnic minority students in mathematics education, which were instigated by macro education authorities, were explored. Chapter 5 described the varying degrees to which implementation of macro educator policies were compulsorily imposed over the fifty-year period of study. Much of the pedagogical and curriculum recommendations of the macro educators were a matter of choice within Victoria's schools of the 1960s, 1970s and 1980s (Horwood, 1997; Ellerton & Clements, 1994; Clements, 1989). The three different experiences of the researcher in three different schools of the 1970s, described in Chapter 5, illustrated the differing degrees of acceptance of the principles of Mastery Learning. Conversely, the provision of physical and human resources of the 1950s and 1960s, final school year assessment throughout the period of study and testing based on the Curriculum and Standards Frameworks (CSF), developed through the 1990s, were largely regulated by the macro educators which included both State and Federal authorities. The Federal macro education authorities also, were largely responsible for the provision of resources for the teaching of English to ethnic minority students and community languages. A National Statement on Mathematics, which was issued in 1989 by the Federal government, was advisory. No national curriculum or compulsory national text materials and resources constrained mathematics teachers within their classrooms.

The concept of a tension was described in Chapter 4 to convey the changing balances which existed over the period of investigation between the intended policies of macro educators and implementations of response within the classroom. What sort of practical steps, therefore, were actually taken by mathematics teachers in response to ethnic minority students within their own classrooms in which their personal policies and management were the significant factors determining the educational environment of their students? How cohesive were the perceptions and reactions of the teachers in their reactions to the presence of ethnic minority students within these mathematics classrooms? What were the major collective influences on their work in the mathematics classroom? These questions will be investigated in this chapter.

### **6.1 Exploring the perceptions of teachers of mathematics in their classrooms**

Several questions could be explored through the perceptions of teachers. Did they perceive difficulties in the teaching of mathematics in ethnically diverse classrooms and, if so, what steps did they take to overcome them? What did they know or employ of the mathematics policy recommendations and management strategies of the macro educators? Were any resources provided from either outside or inside schools of use to them? To what extent did they perceive the need to create their own practical solutions? Was the ethnic minority presence problematical or advantageous to the teaching and learning of mathematics in their classrooms? Did the ethnic minority students bring to the mathematics classroom new ideas and practices which, in the perceptions of teachers, were worthy of exploration and incorporation into their practice? Were there achievement patterns in the mathematics performances of ethnic minority students?

In proceeding with the use of teacher commentary to answer these questions in this chapter the perceptions of responses within the mathematics classroom to the ethnic minority presence will be investigated through the use of questionnaires and follow-up personal interviews of individual teachers working in Victoria over the period of this study.

### **6.2 Perceptions of individual mathematics teachers – The questionnaire**

In order to canvas teacher support an advertisement was placed in the MAV publication *"The Common Denominator"* (July 1997) which has a monthly state-wide circulation. The questionnaire was enclosed in the pages of this publication as a detached two-sided A4-sized flyer. The purpose of the questionnaire entitled *Fifty Years of Teaching School Mathematics in Ethnically Diverse Classrooms* was threefold. The first was to obtain some statistical information, the second to generate a brief picture of teacher perceptions of macro educator and their own responses and the third was to provide an opportunity for each teacher respondent to volunteer for a follow up personal interview. A copy of the questionnaire and advertisement can be found in Appendix A.

### *6.2.1 Terminologies used in the questionnaire*

A difficulty in the wording of the questionnaire lay in finding a word in common usage to convey the meaning of "ethnic minority" used throughout this thesis.

The descriptive term "migrant" student was far more familiar. The wording of the advertisement and questionnaire was constrained by considerations of space. The researcher was aware of complex question of the meaning of the term "migrant" used in the questionnaire but did not define it. In the personal interview extension of the project, however, migrant students were defined by the researcher as those students born outside Australia or born in Australia of at least one overseas-born parent. To qualify, these students must have attended Australian schools or were in the process of being educated in Australian schools for a period of at least one year. It became apparent that this definition did not resonate with the mathematics teachers taking part in the project. Their concept of the term "migrant student" was more elusive and concerned ethnic and cultural connections. The use of the term 'migrant students', used by most teachers in the project, had more to do with a hegemonic viewpoint. It described more accurately those students who qualified in terms of the above definition but who were representatives of those ethnic minorities in the population who came from countries outside Great Britain and Ireland.

The vision held by these teachers of "migrant students" therefore closely approximated the terminology "ethnic minority", which has not included students of Anglo-Celtic ethnic origin, used throughout this thesis (refer to definition in Chapter 3).

### *6.2.2 Level of response to the questionnaire*

A total of 28 questionnaire responses were received and each teacher response was numbered immediately on receipt. Of the teachers who responded to the questionnaire, 55 per cent agreed to take part in a personal interview as shown in Table 24. As the questionnaire was used, predominantly, to select teachers for the personal interviews, it was decided to limit its analysis to aspects germane to the focus of this thesis.

**Table 24 – Teacher responses (each teacher designated by T followed by an identifying number)**

Questionnaires answered only (13)	T3, T8, T9, T10, T13, T14, T15, T16, T20, T22, T23, T28
Questionnaires answered followed up by personal interviews (15)	T1, T2, T5, T6, T7, T11, T12, T17, T19, T21, T24, T26, T27, T29, T30

### 6.2.3 *Who were the teachers responding to the questionnaire?*

Twenty-four secondary teachers and 4 primary teachers responded to the questionnaire and their combined mathematics teaching experiences covered all levels of these divisions.

Twenty-two teachers had worked in Government schools, 4 in Catholic schools and 5 in Independent schools. Of these schools 27 were in the metropolitan area of Melbourne and 3 were in country Victoria (totals were higher than 28 because some teachers had experiences in several different sectors and locations).

Teachers were asked to signify their periods of teaching in ten-year intervals. No teacher in the period 1940-49 responded. Responses were received from two retired teachers with experience in the period 1950-59. Seven teachers with experience in the period 1960-69 responded and for each of the periods, 1970-79, 1980-89 and 1990-2000, an average of fifteen teachers responded.

Questions relating to first school education and language background revealed that 20 teachers first attended school in Australia and of these, 17 listed English as their first language. Of these 17 cases, 10 had no other language and 7 listed varying levels of second languages which included French (6), Italian (3), German (1), Swedish (1), Mandarin (1) and Latin (1). 3 teachers whose first schooling was in Australia listed languages other than English as their first language and these included Italian (2) and Maltese (1). In all 3 cases English was listed as a second language.

Eight teachers first attended school overseas and the countries of their education included Malta, New Guinea, Fiji, Greece, UK (2), Hong Kong and Ireland. First languages listed by this group included English (4), Maltese (1), Hindi (1), Greek (1)



and Chinese (1). Second languages listed by this group included English (4), Gujrati, Fijian, Greek, Vietnamese, French (2), Gaelic (1) and Hindi (1).

#### 6.2.4 *Who were the ethnic minority mathematics students?*

In the questionnaire analysis, the major objective was to create a general picture of the degree of diversity within the ethnic minority origins, as seen in Table 25. In the discussion of personal interview data later in this chapter, these ethnic minority origins were listed with more detailed reports of each teacher interviewed.

**Table 25 – Perceived percentages of ethnic minority students in the mathematics classroom, their “nationalities” and the school sector**

Perceived percentage of migrants in the classrooms, together with sector and school locations.	Most common nationality
<10 per cent Independent/ metropolitan 4	Russian, Israeli, Hong Kong, Malaysian, Singaporean, Chinese, Indonesian, Japanese
10-30 per cent Government/ metropolitan 3	Vietnamese, British, Greek
31-50 per cent Government/metropolitan 6 Catholic/metropolitan 1	Greek, Italian, Asian, Lithuanian, Yugoslavian, Polish, Seychelloise, Mauritian, Indian, Sri Lankan, Lebanese, Chilean, Columbian, German, Dutch, Vietnamese, Arabic, Somalian, Croatian, Philippino, South American, Iraqi, Iranian
51-70 per cent Government/metropolitan 4 Independent/Metropolitan 1 Catholic/Country 1 Catholic/Metropolitan 2	Italian, Greek, Russian, Chinese, Lebanese, Sri Lankan, Ethiopian, Indian, Indonesian, Slovenian, Yugoslavian, Fijian, Turkish, Cambodian, Croatian, Macedonian, Albanian, Vietnamese, South American
>70 per cent Government/metropolitan 6 Independent/Metropolitan 1	Greek, Italian, Turkish, Lebanese, Vietnamese, Chinese, Macedonian, Maltese, Albanian, Korean

#### 6.2.5 *Teacher perceptions of mathematics resources designed for ethnic minority students*

Teacher perceptions of these resources included those resources contributed by the school as a whole or through agencies outside the school, which were provided specifically for the needs of ethnic minority students in the classroom as shown in Table 26.

**Table 26 – Teacher perceptions of internally and externally provided resources**

1. Opportunities to attend courses or information sessions outside the school	11
2. Provision of documentation from expert sources	6
3. Withdrawal of students from the classroom for specific help	12
4. Employment of migrant language aides in the classroom	7
5. Employment of English speaking aides in the classroom	4
6. Meetings/information nights arranged with parents	8
Other comments:	
Generally little or no help was available.	5
Students attended intensive language school before they attended secondary school	1
Years 7 and 8 students of non-English speaking backgrounds (NESB) were grouped together for teaching mathematics.	1
Although some migrant students are withdrawn from Maths for specific help, the school tends to leave migrant students in Maths, withdrawing them in other subjects.	1
Diagnostic tests administered by school places students. Sometimes students move between levels in Maths as English ability changes.	1

Note: 1-6 responses were tick boxes. Other comments were interpreted and grouped by the researcher. The number of responses for each of the comments is signified.

#### 6.2.6 *Personal strategies generated by mathematics teachers to assist ethnic minority students*

The perceptions of most teachers were that ethnic minority students required mathematical help although 5 teachers perceived that ethnic minority students did not need any help in mathematics. Most teachers described at least one personal strategy, which they had devised to address ethnic minority disadvantage. Their comments were collated and listed in Table 27, together with the number of teachers making the comment.

**Table 27 – Perceptions of teachers about resources they generated**

No special provisions were made at all. Migrant students did not need extra assistance.	5
Care was taken with the wording of examination questions.	1
Newer migrant students were seated together with migrant students more conversant with English.	1
Very tight specific formal instructions focussed on a few points.	2
Migrant students were closely supervised and constant feedback was used.	1
Students worked together in groups speaking their own language after teacher explained work to be done. Students were permitted to use language translation calculators (electronic pocket dictionaries which translate words) or to translate for each other. Maths material was taped in 7 languages.	4
Simple language patterns and vocabulary were used when possible and emphasis was given to any new topic-specific vocabulary. Simplified notes and textbooks were used.	6
Extra assistance was given by the teacher in and out of classroom time, including help with language and expression.	2
1 to 1 instruction with teacher or student peer-mentor was used.	7
Revision sheets were provided that went back to basics and cumulative sheets added skills on a weekly basis.	1
Survey was done, where possible, of books used and work covered in previous countries of migrant students, when introducing new topics.	2
Repeat explanations were sometimes given.	1
Migrants were excused from tests in mathematics until their grasp of English was reasonable. Test results were not counted until the teacher was sure they reflected maths performance rather than language inability. Reporting was modified.	5
More questioning was used to establish that understanding had been achieved and students were asked to write their own maths questions to improve language skills.	2
There was greater use of hands-on, concrete aids and activity based approaches. School's Task Centre used for years 7 and 8. RIME materials were used.	4
Several mathematics lessons were taught by a visiting French maths teacher in French, and maths posters were made in Junior secondary classes were displayed in French, German and Japanese.	1
Liaison was formed with English/ESL department for language difficulties experienced in maths problems – used particularly for prepositions in VCE maths problems.	1
Mathematical games and individual learning material and programs were used	2
Co-operative group-work with reporting back of students to the class as a whole gave ideal opportunities for students to pick up maths language display their expertise and develop support networks within the classroom.	2
Students were made aware of language at all the times through discussion.	1
Students were aware that teacher came from overseas and spoke other languages.	1
Teacher undertook professional development e.g. ESL in the Mainstream to develop strategies to help not only ESL students but all students in the maths classroom.	1

### 6.2.7 Summary of questionnaire results

Over 90% of responses came from teachers working in metropolitan schools, which was probably a reflection of the settlement patterns described in the immigration statistics section of this thesis. Most responding teachers came from the secondary division of the government sector but this may have been a reflection of the circulation and readership of the MA'' publication. While 20 out of the 28 teachers first attended school in Australia, 3 of this number did not state English as their first language. Of the 8 teachers not attending their first school in Australia, 4 stated English as their first language. The total therefore using English as a first language

was 21 out of 28 (75%) and this total did not reflect their countries of origin. The complexity therefore of defining migrant status applied in both student and teacher contexts. The range of languages spoken by the teachers was very wide and included examples of European, Asian and Pacific Island languages thus conforming to the elements of both major booms of immigration described in the migration statistics.

The ethnic minority numbers and origins of students covered an astonishing number of nationalities. This was most apparent in the classrooms of teachers where at least 30% of students were listed as migrants. The precision with which teachers noted these in the small space provided on the questionnaire sheet indicated the importance which they attached to these different migrant origins. Words such as 'Asian' and 'European' were rarely used. Teacher awareness of and sensitivity to the national identities of their students perhaps reflected the individualism of Australian educational methodology. The number of migrant students in the classrooms of the majority of responding teachers were very high and did not reflect the 1 in 4 ratio of migrants to national population as described in the migrant statistics.

A minority of teachers made use of or had access to each of the ethnic minority related resources provided by sources outside the classroom. Apart from single comments about school structures no other use of outside resources was noted. The highest number of participants (12) used availability in their schools for withdrawal of students from their mathematics classrooms for specific help. Only one teacher took part in professional development to assist in language aspects of mathematics teaching. However most teachers had developed personal strategies to assist ethnic minority students which they perceived as necessary and these were diverse. Few teachers used the same strategies but most perceived the need for them and had put their particular preferences into practice in their teaching. A small group of teachers (5) perceived that ethnic minority students did not need assistance. No teacher made reference to mathematical advantage in ethnic minority abilities, although different mathematical methods used in other countries were discussed by an even smaller number (2) of teachers.

#### *6.2.8 Some conclusions drawn from the results of the questionnaire*

Most of the 28 Victorian teachers who responded to the questionnaire taught mathematics in classrooms where the ratio of ethnic minority to ethnic majority students within the mathematics classroom exceeded that of the national population, most of them describing teaching experiences which occurred in the last three decades of the twentieth century. Two major peaks of immigration had occurred before this time so that elements of both the European labour force wave and the Asian manufacturing force wave had combined to create highly diverse classrooms and some diversity in the origins of teachers. While a formal definition of 'migrant' status was problematic most teachers did not seem to have difficulty in identifying 'migrant' students in their classroom and they had detailed knowledge of 'migrant' student origins. An implicit belief in the connections between mathematics learning and culture perhaps stimulated most teachers to devise personal strategies which they considered appropriate for the ethnic minority students in their own classrooms. Fewer than 50% of teachers made use of or were aware of each of any systemic responses contributed by mathematics educators in direct response outside the classroom. Ethnic minority disadvantage was the main perception which drove most teachers to use personal strategies directed to the teaching of these students. A minority of teachers perceived that ethnic minority students did not need help.

### **6.3 Personal interviews**

Fifteen teachers agreed in writing at the end of the questionnaire to take part in follow-up interviews. As can be seen, their experiences were not spread evenly across the five decades between 1950 and the end of the twentieth century. It was decided therefore, not to use the decade format as an organising scheme for their responses. Table 28 describes the attributes of these volunteer teachers.

**Table 28 – Attributes and perceptions of teachers interviewed**

SCHOOL	G, C, I	Teacher & Language	Teacher Perceptions, over their years of mathematics teaching experience, of student ethnic minority percentages and origins in their classrooms	
13 Metro Secondary Schools	G	<u>T2 Eng</u>	1970-90+	<u>70-90%</u> : Greek, Italian, Turkish, Chinese, Lebanese, Vietnamese
		<u>T6 Eng, Fre, Germ</u>	1970-74	<u>70-90%</u> : Mainly Western European and also Asian
		<u>T11 Eng</u>	1969-93	<u>51-70%</u> : Russian
		<u>T12 Eng, Swedish, Fre, Ital, Mandarin</u>	1960-90+	<u>51-70%</u> : Albanian, Cambodian, Chinese, Ethiopian, Fijian, Greek, Indian, Italian, Indonesian, Lebanese, Macedonian, Slovenian, Sri Lankan, Turkish, Vietnamese, Yugoslavian
		<u>T24 Eng</u>	1970-90+	<u>51-70%</u> : Vietnamese, Chinese and Cambodian
		<u>T5 Maltese, Eng, Ital, Latin</u>	1960-92	<u>31-50%</u> : Italian, Asian
		<u>T19 Eng</u>	1960-74	<u>31-50%</u> : Greek
		<u>T19 Eng</u>	1975-90+	<u>&lt;10%</u> : Greek, Middle Eastern, South American, Asian
		<u>T21 Eng</u>	1950-69	<u>&lt;10%</u> : Hong Kong, Malaysia
	C	<u>T29 Maltese, Eng</u>	1980-90+	<u>51-70%</u> : Italian, Lebanese, Vietnamese
		<u>T30 Eng, Gaelic, Hindi</u>	1970-90+	<u>51-70%</u> : Italian, Lebanese, Vietnamese
		<u>T7 Eng, Fre</u>	1970-90+	<u>31-50%</u> : S. E. and W. Europe, Seychelloise, Mauritian, S. American, Vietnamese
1 Country Secondary	I	<u>T17 Greek, Eng</u>	1980-90	<u>70-90%</u> : Greek
		<u>T1 Eng, Fre, Ital</u>	1970-90+	<u>&lt;10%</u> : Russian, Israeli
		<u>T17 Greek, Eng</u> <u>T7 Eng, Fre</u>	1990+ 1970-90+	<u>&lt;10%</u> : Asian <u>&lt;10%</u> : Japanese, Chinese from China, Singaporean, Hong Kong, Malaysian, and Sri Lankan
1 Country Secondary	C	<u>T27 Ital, Eng</u>	1970-90+	<u>60-70%</u> : Italian and a few Chilean, Philippino, Croatian and Spanish
1 Metro Primary	G	<u>T26 Eng</u>	1970-99	<u>30-50%</u> : At first Macedonian and Greek, then Cambodian, Vietnamese, Iraqi, Iranian, Somalian

Abbreviations used in this table are as follows:

Metro is an abbreviation of Metropolitan

G, C and I stand for Government, Catholic and Independent respectively

The designation T6 Eng, Fre, Germ means that Teacher number 6 has answered that English is his/her first language and that French and German are second languages.

Personal interviews were arranged and took place by appointment in the schools where volunteers were employed, or in their own homes. The same questions were asked of each teacher and the verbal answers were directly transcribed on to personal interview forms previously prepared by the researcher. Prior to the interviews the question format was submitted to and approved by the Ethics Committee of Monash University, Clayton Campus, Melbourne. Each teacher was obliged to sign a Consent form before being interviewed. Examples of personal interview format and consent form can be found in Appendices B and C. Information exchange in interviews was purely verbal with immediate transcription by the researcher in the form of notes. Also verbal commentary made by teachers, in addition to answers to questions, was transcribed by the researcher if the teacher wished to contribute further comment.

The data collected in the personal interviews will be analyzed in the following way:

The perceptions of classroom teachers will be discussed in three divisions.

These three divisions are:

Teacher perceptions of responses to ethnically diverse mathematics classrooms made

- by Government and sector authorities (Sections A and Section B of personal interview question sequence)
- by School administration and school mathematics departments (Sections B and Section C of the personal interview question sequence)
- in their teaching practice within their own classroom to their own students (Section D and E of personal interview question sequence).

The context used for the analysis of the perceptions of these teachers will make some connection with the macro responses of the decades described in Chapter 4. The responses will therefore be analyzed under the following headings:

- School environment
- Language resources
- Mathematics education pedagogy
- Mathematics education curriculum
- Regulatory assessment and reporting.

Following the presentation of data from the 15 personal interviews a summary of results will be presented in the form of a table in section 6.5 of this chapter.

Appendices include a copy of the personal interview question sequence used by the researcher, an example of one teacher's transcribed response to the questions and an example of the transcribed responses of all 15 teachers to a particular question.

### *6.3.1 Results of personal interviews*

In reporting on teacher perceptions the researcher looked for comments of a similar nature made by more than one teacher although some single teacher perceptions of special interest have been selected. Three factors should be noted in the reports of perceptions of teachers. These are:

- Some comments were general perceptions about all subjects at the school(s) in which these teachers taught mathematics. Nevertheless there were connections in these comments to the teaching of mathematics in their classrooms. The researcher endeavoured at all times to emphasize the need for perceptions related to mathematics in personal interviews but found it impossible to avoid some crossover points.
- Terminology – the researcher retained the word 'migrant' as it appeared in quotations of teacher comments but in descriptive passages the terminology 'ethnic minority' was used as described in Chapter 3. The word 'Australian' if used in teacher quotation was used verbatim. 'Australian', in the opinion of the researcher, had a close correspondence to the term 'ethnic majority' as described in Chapter 3 and earlier in this chapter.
- It should be noted that the comments recorded were the expressed viewpoints of teachers interviewed and do not necessarily reflect the personal opinions and knowledge base of the researcher.

The first question concerned the impact of change in mathematics in order to establish a mathematical focus for teacher comments on responses to ethnic minority students in the mathematics classroom. In a number of subsequent discussions, however, comments concerned general aspects of education rather than mathematics specifically. In some cases there was a blurring of divisions used in the personal interview format. For example, comments sought on sector policy often related more to school policy. Comments were considered therefore in the context judged appropriate by the researcher.



The major change experienced by each teacher, which made significant impacts on their teaching of mathematics, included the perceptions shown in Table 29:

**Table 29 – Teachers and change in mathematics**

Number of teachers	Identification of significant change in mathematics by teachers
9	<p style="text-align: center;"><b>Regulatory Assessment:</b></p> <p>The changing nature of assessments at secondary level - HSC, VCE (1970s and later), abolition of Leaving and other Certificates in Victoria in the 1950s and 1960s (6 teachers)</p> <p>The motivating effects of the introduction of LAP tests in the 1990s to teachers of mathematics at primary level (1 teacher)</p> <p>Restrictive nature of assessment through the introduction of CSF in the 1990s (2 teachers)</p>
3	<p style="text-align: center;"><b>Curriculum and Pedagogy:</b></p> <p>The difference in curriculum and pedagogy experienced in moving from one Australian state to another in the 1980s.(1 teacher)</p> <p>The introduction of New Maths and the resultant new American texts, the need for retraining of teachers and the introduction of a more scientific approach in the 1970s (1 teacher)</p> <p>The introduction of problem solving in mathematics – opportunities for creativity through the government funding of new teaching resources in the 1970s (1 teacher)</p>
1	<p style="text-align: center;"><b>Resources:</b></p> <p>Cuts in government funding for the employment of staff in welfare, libraries and ESL departments in the 1990s.</p>
1	<p style="text-align: center;"><b>Union Activities:</b></p> <p>Domination of teaching by VSTA industrial action in the 1970s</p>
1	<p style="text-align: center;"><b>Research:</b></p> <p>Research into education for gifted mathematics students in the 1980s</p>

It can be seen that, in identifying the changes in mathematics education which made the greatest impacts on their teaching, all 15 teachers interviewed referred to external factors. Change in regulatory assessment was the most often named significant change factor with change in curriculum and pedagogy containing the next highest number of teacher comments. However, different change factors, mentioned once only, also stemmed from external agencies, namely from the both the extra provision of and the reduction of government funding of support resources. Also mentioned were educational union activity and university research.

The remainder of the personal interview format concentrated on the perceptions of teachers on responses to the ethnic minority students of mathematics at macro educator, school and individual teacher level. The most common directions of these comments only will be discussed.

### *6.3.2 Teacher perceptions of responses of government and sector authorities to the ethnically diverse mathematics classroom*

Despite the attempt to concentrate comments on mathematics education, when referring to government and/or sector responses, teachers' comments related to more generalized factors. This may have been a function of the fact that the majority of teachers (9 teachers out of 15) responded that they were unaware of any government response and/or sector response to the presence of ethnic minority students in the mathematics classroom. Two of these responses were:

T2 – The connection between government policy and migrants was a big black hole. There was no real assistance in the teaching of mathematics from the government, no pre-training of teachers or help about even basic symbolism or differences between migrant students. You learnt about it in the classroom.

T17 – I don't think so. The problem of language was discussed.

An analysis of teachers' perceptions of macro educator intervention revealed similarities and differences, as will be shown below.

#### *6.3.2.1 Environment and the macro educators*

In this section comments were made in relation to school environment as a whole. Those teachers who commented on the general environment of their schools, described desired enrolment patterns as a response related to sectors rather than a response under the "umbrella" of government. Two teachers in Independent schools spoke of active campaigning for students from East and South East Asian countries in the 1980s – one comment related to enrolment of Full-Fee Paying students from Hong Kong, Singapore and Malaysia and the other to the establishment of a sister school in China and a policy of attraction of Chinese students to the school. Government schools were restricted by zoning regulations until the 1990s, but were able eventually to manipulate their populations. One teacher interviewed described

one government school which campaigned to attract Macedonian students because of past tradition and another which attempted to restrict its Russian enrolment so that its ethnic minority population was more balanced. One teacher of a Catholic secondary school spoke of its establishment for the teaching of the very high number of Italian families in its area and another teacher spoke of the mission of his Catholic school which was the education of children in the "margins of society" which included a large number of immigrant children. Two teachers referred to homogenous enrolments of religious schools established by ethnic minority populations such as Jewish, Islamic, Greek and Japanese schools in which religion and/or culture were the reasons for their establishment. The Federal government policy of funding for Disadvantaged Schools, some of which was calculated on the basis of the magnitude of immigrant intake, was noted by one teacher. Only one teacher spoke of government funding directed towards the teaching of mathematics, transcribed as follows:

Extra funding was made available for migrant teaching by Mr Whitlam in the mid-70s but it was not used as best as it could have been. I used it to research texts, which had less wordy exercises. Formal language was a weakness – the form of language in the texts was too academic for migrants. The range of language was too hard – they did not know what was going on (T29).

In conclusion a majority of the teachers interviewed were unaware of government and/or sector response to the presence of ethnic students within the mathematics classroom. Six teachers however noted that in all three sectors, Government, Independent and Catholic, schools were able to implement different selection policies in their enrolments of ethnic minority students. One teacher only, reported direct government funding, which he attributed to the Labour Government of the 1970s, and which he used for the research of suitable mathematics text books for ethnic minority mathematics students.

#### 6.3.2.2 Language and the macro educators

In response to the question of language, six teachers stated that they were unaware of ESL help connected to mathematics. 7 teachers noted the need of ethnic minority students for help in English and the language of mathematics. Those who referred to the government commitment to language resources for ethnic minority, in the form of

ESL departments in schools, lamented their reduction and closure in the 1990s. Teacher experiences of language assistance in mathematics classes varied considerably. One mathematics teacher formed a close liaison with a Government Language Centre situated on the opposite side of the road to the school. She was able to follow the mathematics progress of students as they moved from the Centre to the school. However she had heard that the Centre was to be closed (T11). Another teacher described his school, which was classified as a Disadvantaged School and which was provided with ESL and Special Departments. In this case, students were withdrawn from mathematics classes to attend ESL classes. This teacher (T2) perceived that this practice hindered their progress in mathematics. In contrast, T12, who speaks a number of languages (see Table 28), worked closely with the ESL department when there was one, and reported on that connection as follows:

I am trained in Maths and English and can focus on the language of Maths. Maths teacher training is too narrow. I worked closely with the ESL teacher and now this has been lost through funding cuts (T12)

Another teacher noted that he could only remember vetting the test CATs of the VCE for appropriate language. The 3 overseas born ethnic minority teachers spoke of the need to be very conscious of language. One of these teaching in government schools, was frustrated in his efforts to communicate in both a language and a cultural sense:

I wanted to teach migrant students – Maltese, Italians – but I kept being appointed to schools with largely Anglo-Saxon students even though I applied for schools in migrant areas. Was it policy not to put migrant teachers near migrant students of the same nationality? (T5)

With the exception of teachers in ethnic religious schools, a number of teachers spoke of the small number of ethnic minority staff working in their schools. Teachers spoke of the usefulness of ethnic minority aides in extra lessons after school or at lunchtime but described them as a rarity in mathematics classes and did not think they were the result of government funding.

In conclusion, most teachers perceived that language assistance, both in English and in the language of mathematics, were required for ethnic minority students and that generalized ESL assistance was available in schools through government agency.

There was also an awareness that these facilities had suffered cuts in funding in the last ten years. However their experience of the relationship between ESL and the classroom was both good and bad and a significant number saw value in the employment of ESL teachers with more mathematical experience and the use of ethnic minority aides in mathematics education. The three ethnic minority teachers of the study were emphatic about the importance of language in mathematics. One questioned, in the light of his own experience, whether it may have been government policy not to employ ethnic minority teachers to teach ethnic minority students.

#### 6.3.2.3 Curriculum and pedagogy and the macro educators

In relation to government intervention in curriculum, a general perception (11 teachers) was that they were not aware of any government or sector policy connection with ethnic minority students in relation to curriculum content. In one example a teacher noted that policy of government which encouraged students to remain longer at school caused cultural factors to emerge in his classroom as follows:

The government's policy of encouraging students to stay at school right through to year 12 meant an increase in the school's resources to cater for a more varied student population. I felt this particularly as I had come to this government school from an independent school where chalk and talk was the norm and there was a tradition of staying longer at school. In relation to migrants, cultural factors emerged. I observed a difference in attitude between Greek girls and Greek boys. Asian students arriving to do their VCE had great trouble with writing sentences in their VCE reports and asking questions was difficult for them in a cultural sense. It meant a change of values for them. They needed help (T19)

The introduction of new pedagogy related to the teaching students as individuals and the introduction of projects and problem solving in mathematics were seen by a number of teachers as welcome interventions of government. However in relation to ethnic minority students, difficulties with language escalated as teachers noted the increase of language usage which accompanied these changes. As a consequence of these language concerns teachers perceived a necessity to change their pedagogy to one to one teaching or small group teaching outside the classroom. Teachers noted the increase of hours of teaching needed for assistance to ethnic minority students and

the need for smaller classes to implement these changes. In relation to ethnic minority students one teacher response was:

VCE changes altered teacher workload – it increased it and I needed time to teach students after work. This time was available to all students but Asian students were often present. They were more persistent than Anglo-Celts. They sometimes pestered for individual help (T24)

However, one teacher resisted change to his teaching methodology which he described as “keeping students at a distance”. He responded:

I wrote specialist books for parts of the mathematics classes but I still used a teacher directed style (T5)

In relation to the difference in teaching methods in two different government schools, the only primary teacher interviewed, noted:

I am aware of different uses of materials in different government schools. At one school the teaching was very formal possibly due to a large Asian cohort whose parents were professional and business people. In another school I had to introduce a more hands-on style of teaching to compensate for Goodger mathematics where students worked at their own pace, which left students lacking in basic skills. To augment mathematics resources we used DSP money but this was an individual effort rather than a government sponsored one (T26).

In combining then, teacher perceptions of curriculum content and pedagogy, a large majority of teachers perceived no intervention of government in curriculum to provide specific strategies for ethnic minority students, but recognized changes in pedagogy, which, while not directed specifically to ethnic minority students, created a number of changes related to their education in mathematics. While teachers welcomed the changes of pedagogical approach in, for example, problem solving, the increased language requirements, meant that more individual help was needed by ethnic minority students. This help was difficult to provide in large classes, smaller group strategies were needed and teachers working to help ethnic minority students outside the classroom noted the extra hours of teaching time this involved. Finally the only direct response in teaching methodology to ethnicity was described by the only primary teacher interviewed. This teacher perceived very formal teaching methods in mathematics and the use of different mathematical resources in a

government primary school which she perceived as a response to the large Asian cohort attending that school.

#### 6.3.2.4 Assessment and the macro educators

Teacher comments about assessment requirements instigated by government were variable. A sample of comments appears below:

The CSF does not allow teachers to decide when to assess or to work out appropriate measures for assessing and reporting migrant students (T1)

The CSF is restricting. Jan Thomas wrote in a recent article about highly focussed assessment being more difficult for migrants (T 12). (This teacher could not remember the source of this article.)

The little bits of CSF caused teachers to change their ways into more restricted subject divisions. This affected their teaching to all students, including migrants (T11).

The VCE school-based CATs caused problems for migrants especially Asian migrants.

In their culture of mathematics education the correct answer was important for them rather than the logical methodology which is the basis of assessment in Victoria. It caused anxiety. In their search for correct answers, VCE students sought help from university students who answered in complex mathematics which the VCE students did not themselves understand (T7).

The VCE gives migrants more scope. They do well but the descriptive wordage is difficult for them (T30).

Concluding, teachers were ambivalent about the effects of regulatory government assessment in the VCE and the CSF. Three teachers commented on the disadvantage created by the rigid nature of the CSF and how this disadvantaged ethnic minority students. VCE CATs contained aspects, which were helpful and unhelpful to ethnic minority students.

### *6.3.3 Teacher perceptions of school administration and school mathematics department response*

In this section school environment will be investigated through the perceptions of teachers about the reasons for ethnic minority attendance and the ethnic origins of both the staffing and the students at the school. This will be followed by teacher perceptions of staffing resources such as ESL departments of and Language Centres, teacher aides and the degree of connection which existed between these resources and the mathematics classrooms at the school. Teacher perceptions of responses in the mathematics curriculum and mathematics pedagogy of the school will be explored through school administration in the allocation of mathematics periods, timetabling of mathematics, selection of pedagogies and associated resources and the selection of curriculum content. Finally teacher perceptions of the assessment and reporting methods and their relationship to ethnic minority students, used in their schools, will be investigated.

#### *6.3.3.1 School environment*

In investigating teachers' perceptions of the environment of the school, the source and degree of ethnic presence in the school were explored. Several teachers were not aware of any factors which attracted ethnic minority students to their school (4 teachers). Others spoke in terms of zoning of schools in natural catchment areas of ethnic minority families (6 teachers). A typical response was:

Location, socio-economic reasons, new migrants gravitate to particular locations (T19)

Two teachers indicated that schools had connections with migrant hostels and language centres (T11, T24).

Given that the government census information referred to in Chapters 2 and 3 clearly indicated that the great majority of immigrant families settled in inner city areas on the east coast, the response from the only country school (Catholic secondary school)



would seem to be atypical. In this case the teacher, a second generation Italian, responded as follows:

Our school is a Parish school in an area where Italian immigrants came to grow crops. Until recently all migrant students in our district tended to go to our school but lately there has been a swing away, possibly for socio-economic reasons related to farming. The farmers are changing their crops – who will this attract? (T27)

However the concentration in his school of one ethnic minority group rather than a more diverse ethnic minority was echoed in the answer of a first generation ethnic minority teacher, born in Greece, who taught in an Independent metropolitan secondary school. He described this school as follows:

The school was a Greek Community School, run by the Greek Orthodox Church for Greek students and it included religious studies in its curriculum (T17).

In both of these two schools the mathematics teachers, who were both teaching at VCE level, were of the same nationality as the great majority of their students. Two teachers of Anglo-Celtic ethnicity also noted single ethnic concentrations of students. In both of these government schools, students of a particular ethnic origin formed the largest component of the ethnic minority student population. The first teacher described an active campaign on the part of a government school to retain Macedonian students who had previously attended the school in large numbers before their parents moved to suburbs of higher socio-economic status. Parents were contacted by the school in their new locations in another suburb. There had been a number of Macedonian staff at this school (T26).

The second of these teachers described the schools concern with the large number of Russian students enrolling in the school and its desire for the population to be more varied. She added:

The location of our school is known in Russia. The language centre in our area recommends this school for able mathematicians rather than neighbouring schools (T11).

This last comment described attendance at the school as a function of its academic reputation. This was similar to a comment made by a teacher in an Independent school which also attracted a large Russian population. The teacher described three reasons for this attraction in the following terms:

(1) The location, (2) the "right" level of Jewish orthodoxy (3) the Russian group includes ambitious intellectual students and the school has a good academic reputation now (T1).

No teachers were aware of scholarships or incentives offered by the school to students in mathematics, let alone ethnic minority students.

In conclusion, the general tenor of these comments seems to indicate that homogeneity, or at least some rejection of diversity, was perceived to be advantageous by some schools and their mathematics teachers. One teacher however spoke of the need for balance in ethnic enrolment and undesirability of a large number of ethnic minority students of one nationality. The interest of ethnic minority communities in "good schools" for their children and the fact that one government school was known by ethnic minority students in their own country before their arrival signified perhaps the high degree of importance attached to education by ethnic communities.

#### 6.3.3.2 School staffing resources including language-teaching resources for ethnic minority students

Nine teachers noted that there were no staffing provisions for ethnic minority students directed to mathematics even where there were ESL departments in the school. ESL help was directed to ethnic minority students in English and Humanities studies.

While a typical response was:

No. ESL was really directed towards literary subjects (T7), one of these teachers did not see the need for language help in mathematics. This teacher was a first generation Greek immigrant teaching mathematics in a Greek ethnic school. His reply in relation to the availability of ESL in his school was:

No, not to Maths but to English. In Maths, language is not a problem and migrant students often use their own language in discussion (T17).

Another teacher of ethnic minority origin commented about his ethnically diverse classroom:

In senior maths classes it is always assumed that students are literate in English. There is a full allotment of periods of help in English but these teachers give very little help in maths. Migrant students have problems with statistics with words and concepts. I concentrate on communication with another person. HOW to write down is important - I emphasise not the answer but logical communication. My methodology is like teaching another language (T 29).

In contrast to these responses one teacher spoke of her experiences of language assistance in two schools, one Independent and one Government, in the following words.

The ESL department supported maths (government school) and overseas students went to English Language class once per week - maths problems were discussed in these sessions (Independent school) (T11).

Another teacher response was:

Remedial help was available for language difficulties (T21).

Other staffing resources were described by teachers in relation to the needs of ethnic minority students in mathematics. These included:

Russian education devotes large blocks of time to particular areas e.g. 6 months devoted to trigonometry leaving gaps in other areas. The school attempts to fill these (T1).

Migrants sometimes cannot attend maths trips for socio-economic reasons or cultural reasons. Permission can be difficult to get. The school offers assistance and guidance in these instances (T12)

Finally, another teacher described the availability of aides within mathematics classes in her school in the 1970s but commented also that this resource was no longer available (T27).

In conclusion, the majority of teachers (11 teachers) perceived that, while ESL departments were present in schools, the help they could provide for ethnic minority students was limited. Where ESL was felt to be useful the mathematics teachers had very close working relationships with ESL teachers. The usefulness of aides in the classroom was also noted. Other staffing help related to extra classes in mathematics provided by the school to allow ethnic minority students to bridge gaps in their mathematics education, and assistance to ethnic minority families, where cultural factors clashed with the attendance of some ethnic minority students at mathematics excursions.

#### 6.3.3.3 School curriculum and pedagogy

These two factors will be discussed together as teacher comments tended to cross over between pedagogy and curriculum. All 15 teachers attested to the high status of mathematics in their schools as demonstrated by a high allocation of time to its study. Generally its importance was either commensurate with the study of English or with the study of English and Religious Studies. 13 teachers commented that the most common level for a change of mathematics from a compulsory to a non-compulsory study was at year 10 but that, in reality, most students continued to study mathematics to at least year 11 level. One contrasting comment referred to mathematics in the 1960s as follows:

In the 1960s maths was compulsory to year 10 level but the school leaving age was at year 9 level. Maths classes became very small, about 5 per class and rooms were designed for the teaching of small classes (T5).

This teacher also made the general comment that students of Southern European origin in the earlier years of immigration were dedicated to the idea of creating financial stability in their families and left school at the earliest opportunity to gain employment. Their mathematical experience was therefore cut short, not through lack of ability but for socio-economic and cultural reasons.

The only primary teacher interviewed commented on an increased importance of mathematics in primary schools which she attributed to the introduction of LAP tests in the 1990s. She commented:

LAP does not dominate but it is a starting point for awareness and formal approaches to mathematics. Teachers now have accountability in maths to each student. There has been a change of pedagogy and we have returned to textbooks (T26).

In questioning teachers about any modifications to the mathematics curriculum in relation to ethnic minority students the general perception was that were none (11 teachers). A typical response was:

No. Migrant students go straight into maths classes. ESL lessons are substituted for other subjects considered not as important such as LOTE, history and geography (T1).

In the experience of one teacher ethnic minority students were given an orientation program before joining mainstream classes with the exception of mathematics and creative arts. They joined the latter two disciplines immediately on arrival (T7).

In contrast to the perceptions of majority of teachers that there was a lack of curriculum modification for ethnic minority students, three teachers' perceptions indicated modification of mathematics programs for ethnic minority students. Their comments were:

Subtle modifications occurred in maths. During the 1970s cultural factors were given much focus. Efforts were made to alter Science and Maths curricula to better suit Greek girls, the purpose being to encourage them to stay in these subjects (T19).

and

There are two mathematics classes of ESL students at each of year 7 and year 8 levels called 7A and 8A (T12).

This second type of modification was referred to also by two others teacher who described its failure and abandonment by their school. One of these teachers reported on the placement of all "ESL students" into two of the eight mathematics classes at

each level. In this school one nationality was predominant in the ethnic minority and this formed a close knit group. She commented:

They spoke in their own language in class when excited about their maths, took longer to converse in English and did not integrate. A policy of mixing classes was instituted by the school as a result (T11).

The other teacher described a similar experience but commented that the student experience caused an appraisal of staff relations. The outcome of staff discussion was that English became the language of both the staffroom and the classroom.

Most teachers described either a random distribution of ethnic minority students or an even spreading of ethnic minority students between mathematics classes at any level. One teacher lamented that in the 1970s, while smaller classes could be arranged in other subjects, mathematics classes were always large (almost twice the size) and this created difficulties in giving attention to the needs of ethnic minority students (T19).

In conclusion, all 14 teachers from secondary schools spoke of the importance of mathematics in their school curriculum, demonstrated by its compulsory designation in most cases to at least year 10 in secondary school and large time allocation. The LAP test had activated a higher profile to mathematics in primary levels according to the only primary teacher interviewed. Despite this important status, however ethnic minority students were given little preparation on arrival in secondary schools and were most often placed directly into regular mathematics classrooms on arrival. Random selection or balanced selection of ethnic minority students in classrooms at each level was the usual strategy of secondary schools. Where the grouping together of all ESL students at a level in secondary schools had occurred, cultural conflict had created very difficult situations. School policy, however, kept class numbers, in the opinions of teachers interviewed, too large in mathematics and this contrasted with other subjects taught in the school.

#### 6.3.3.4 School assessment and reporting

Regulatory curriculum and assessment policies and their application by government macro educators such as the VCE at the end of year 12 in Victoria or the Australia wide CSF were applied uniformly to all students. School based changes to these

prescribed assessments and courses, as a response to ethnic minority students, or any other division of students with special needs was not within the power of school administration and internal school structures. Schools could shape their curricula preparations and their pedagogy. Government funding was available in a general sense for language assistance in the form of ESL departments and special education departments, although, by the 1990s, this funding was curtailed. Therefore, in this section, the perceptions of teachers of school response in this section were not explored. However, within curriculum, pedagogy and language response sections, related teacher perceptions were noted.

#### *6.3.4 Teacher perceptions of their own personal strategies in the mathematics classroom and the responses of their own students*

Classroom environment was explored through the perceptions of teachers in their own teaching strategies within the mathematics classroom and the responses of their ethnic minority students. Teachers comments included reference to class sizes, their own morale in the classroom and the nature of teacher-student relationships and student-student relationships. Teacher perception of language resources referred to the suitability of ESL help available and their own responses to counteract what the great majority of them saw as a serious problem requiring constant attention, namely the lack of English skills in the ethnic minority student cohort. Teacher responses in curriculum were often linked to curriculum but the question of pedagogy engaged most of their perceptions. There was evidence that their pedagogical responses differed according to which immigration periods they worked in. Most perceptions had much to do with English language skills and/or the different languages of mathematics their ethnic minority students brought to the classroom. It was clear, however, to most teachers of the 1970s and later, that cultural difference also had to be recognized and included in their teaching strategies. Their choice of suitable materials, classroom structures, and their participation and acquaintance with outside resources directed towards ethnic minority teaching were included in their comments on pedagogy. Finally, some but not all teachers were able to generalize in their observation of attitudes, patterns of achievement and aspirations of different ethnic minority groups of students.

#### 6.3.4.1 Teachers in the mathematics classroom environment

The problem of English language skills and how to deal with it was a constant refrain in many of the teacher responses. Cultural differences of ethnic minority students meant that problems of understanding had to be responded to in different ways and along ethnic lines. Middle Eastern girls and many Asian students would not communicate their problems within the walls of the classroom. Asian students, however, responded to 1:1 assistance outside the classroom. One teacher described the cultural traits he recognised in his classrooms:

Yes, there were problems. There are differences based on ethnicity. The Greek, Lebanese and Turkish students are active learners. The Italians students are outspoken and forward. The Vietnamese and Chinese students are passive and it is difficult to engage them in class (T2).

Individual help was difficult in what some teachers judged as large classes. These classes were sometimes the result of immigration and sector policies particularly in Catholic schools. The need for different approaches to language problems was less of a problem where the ethnic minority students formed a very high percentage of the class such as in the Greek Orthodox school (T19) and in a country school mainly peopled by Italians (T27). These mathematics teachers were of the same nationality as their students. Both of these teachers described the advantage of being the same nationality as the class. One responded:

In the Greek school I was employed deliberately because I was Greek. Greek students were able to converse with me at lunch and recess times (T17).

Two teachers in inner metropolitan Catholic schools described large classes containing students of diverse ethnic origins as follows:

General mathematics classes at VCE level were very large. In my class there were 37 girls – they had to sit along benches around the sides as well as in the middle of the classroom. The students (about 10 in all) who were taking Pure and Applied Mathematics went to class in a nearby very large Catholic boys school which held mathematics in huge classrooms which accommodated 50 students at a time. Help was available on Saturday mornings in this school but it was monopolized by the boys. Some of these girls wanted to change their subjects after they had started but there was no room for them to join the General Mathematics classes at their own school. By 1980 the General Mathematics had



been split into two, then three classes – the girls in Pure and Applied mathematics were able to take these subjects in their own school. I suspect that the school's classification as disadvantaged, because of the number of different ethnic minority students within its population, may have played a part in the reduction of class sizes (T7).

and

In General Mathematics the number was so large that I could not cope. I transferred to Foundation Maths (for less able students). Streaming is essential when there are so many different levels of understanding (T29).

There were contrasting comments about teacher morale in the ethnic classroom. Two teachers described their enjoyment of the challenge of teaching mathematics to ethnic minority students. Another expressed her worry and frustration. These two attitudes can be seen in the following comments:

Although I feel the need for help I enjoy teaching these classes even though there is frustration (T12).

and

I would like an aide but this is not possible for financial and staffing reasons. A Physical Education teacher used to help out in his 'spare time' ...but maths is so demanding and individual. I have felt quite desperate in Grades 5 and 6. I have been worried that maths teaching has been limited in previous years because of the lack of teacher experience (T26).

Finally an understanding of student-student relationships and their own relationships, either in the context of mathematics or in a more personal way, with their ethnic minority students, were seen as worthy of attention by all teachers with the exception of one teacher who began teaching in the earlier years of the assimilation period and responded 'irrelevant', 'no comment' or 'I was unaware of these relationships'. The other teacher working in this period described the care he took with Asian students with direct questioning because they 'were less responsive and shy'. He also described a House system in the school where it was the responsibility of a student in the house to care for and be aware of the general needs of an ethnic minority student.

There was commonality in the comments made by others about teacher-student relationships such as:

Yes it is helpful to know the cultural backgrounds of migrant students – how their topic sequences were different – the depth to which they have been taught in their own countries (T1).

Yes. It shows respect for any background of culture and you can acknowledge the role of culture in mathematics (T19)

Yes. Knowing different ways of doing things are helpful in reaching understanding (T12).

Yes. The teacher should be conscious of the origins and history of mathematics in students' countries, for example, the invention of zero by the Arabs, the use of Greek symbols.... (T2).

Yes. I get the Macedonians to show their different ways of doing long division and fractions on the board and how they name figures differently so everyone can learn (T26)

At our school the school paper and videos show some of the experiences of ethnic minority students, especially the Vietnamese boat people so that classmates are aware of their suffering (T24)

I make an effort to know student origins. It is important to be friendly in maths. The atmosphere needs to be positive (T29)

Student-student relationships were considered generally friendly and students were helpful towards each other in the perceptions of six teachers (T6, T17, T19, T27, T29, and T30). The conflicts, which were described generally, related to conflict between different ethnic minority groups and these conflicts were related to cultural differences (T2, T12). A number of teachers referred to the reticence of Asian students and their general passivity in class. These were generally Chinese and Vietnamese students (T7, T17, T29). Some ethnic groups formed very close-knit

groups. The solidarity of Russian and Lebanese students was noted by two teachers (T1, T29). Examples of these contrasting perceptions were:

Students were generally friendly towards each other. There was a happy atmosphere in the class (T6).

I am endlessly surprised how well different nationalities get on together. Occasionally there is antagonism e.g. between Turkish and Lebanese girls and between Greeks and Lebanese. I have to minimise this in the mathematics classroom e.g. by separation and never using certain words. Verbal aggression based on nationality was banned in the school and students have explicit instructions concerning this (T2).

I enjoy teaching mixed origins very much. I am not aware of tensions. For the Vietnamese, I run special classes. Other nationalities mix widely but I use mentor systems for the Vietnamese (T29).

Russians tend to stick together in their own group. They tend to challenge school rules. They will not stay behind to discuss problems in their work but will stay behind to argue the allocation of marks in the correction of their work (T1).

Finally the teacher of the country school spoke of the helpfulness of both Anglo/Celtic and Italian-origin students to ethnic minority students in her mathematics classes. The latter were often of Italian nationality. She believed strongly however, that her own Italian ethnicity played an important part in the stability of her classroom as demonstrated in the following comment:

Australian students are helpful to migrants. Italian origin students are also helpful. The students know of my Italian background...they know that there will be a high demand on effort and a disciplinarian attitude (T27).

In conclusion the recognition, in teacher perceptions, that different cultures required different strategies in the teaching and learning of mathematics was significant and this resonated with the immigration policy of multiculturalism and the contentions in mathematical research that successful mathematics education requires an understanding and inclusion of cultural context. However, whether any of the teacher perceptions were based on theoretical background knowledge was not explored. The

advantage of being of the same nationality as a large number of students in the classroom alleviated the problem of language according to two ethnic minority teachers. Teachers, in perceiving the individual requirements of students in language and culture in the mathematics classroom again spoke of the need for small classes but, at the same time described the generally friendly atmosphere in their classes, despite special measures which were needed at times when ethnically based conflict occurred. Teacher morale however, described by three teachers, varied from enjoyment to desperation in their ethnically diverse mathematics classrooms.

#### 6.3.4.2 Teacher perceptions of language resources

Most teachers found that language created a problem in the mathematics classroom (T1, T6, T7, T11, T19, T24, T27 T29, and T30). These teachers referred to the obscure language of textbooks, Australian pronunciation, a cultural difficulty in writing down opinions, the ability of students who came from former British colonies to read English but not to speak or write it, the characteristic of English in which the same word has different meanings thus creating problems in statistics (mean, mode) and the need for ESL help which included a knowledge of mathematics. In contrast, T21, working in an elite government school (years 9-12) in the 1950s and 1960s found little difficulty with English in mathematics. Typical comments included:

NESB students have poor expression and poor understanding of the written word. They require detailed explanation by the teacher in class project work. I had to make sure the students understood. Students had problems about writing down opinions (T24).

Australian vowels were a problem. The Japanese are familiar with "American" English and found "Australian" English difficult. I had to emphasize consonants and carefully pronounce vowel sounds (T7).

Language is a struggle. I try to use Latin words (students are largely Italian) such as, for example, "radicum" or "radico" for "root"(T27).

I use ESL help for Years 7 and 8 but literacy AND numeracy are needed (T12).

Yes there are problems with language but they are not insoluble - group talking was effective and the rephrasing of tests when there was a lack of understanding helped (T11).

In conclusion teacher perceptions related an enhancement of mathematical understanding in their students to language education in two fields – firstly, the need for ESL help in English which included a knowledge of mathematics language and secondly, a knowledge on the part of the mathematics teacher or classroom aide of the structure and usage of major ethnic minority languages in their classrooms.

#### 6.3.4.3 Teacher perceptions and strategies in curriculum and pedagogy

Few teacher perceptions were directed to curriculum but teacher perceptions of their pedagogical strategies over which they had sole control, elicited detailed responses. Most of the teachers interviewed were of Anglo/Celtic ethnicity and their responses were related to their cultural identities and their perceptions of the form pedagogy should take. As has been seen in the study of decades in Chapter 5 the notion of problem solving was a popular direction in Australian school mathematics of the 1970s and 1980s which was a manifestation of an underlying tenet of constructivist philosophy. The practical implementation of this philosophy is the contribution of both teacher and students to the teaching and learning process. Thus such activities as class participation and student contribution in group activities are important in Australian mathematics education and it was not surprising to see that the relation of these factors to the mathematics education of ethnic minority students were a matter of concern expressed in teacher perceptions.

There were three major categories of these perceptions:

- a) The recognition of different classroom behaviours in the mathematics classroom within ethnic minority groups, based on cultural factors, and the need for differential strategies or accommodating strategies such as grouping strategies and the use of ethnic minority languages in the classroom.
- b) The necessity for using a number of texts and their own notes because single text books and other resources were generally inadequate.
- c) The necessity of the provision of professional development opportunities and information resources.

Most perceptions of teachers were related to these categories. General commentary and typical responses appear below.

(a) Perceptions of teachers were very individual in their recognition of differences between ethnic groups in their learning of mathematics. Some, but not all of them, observed these cultural differences and devised differential strategies based on these observations. Strategies were devised by individual teachers based on observations, which, included the perceptions that, Chilean students took longer to learn to carry out logical steps in problem solving, and Chinese and Japanese students were distressed if singled out in classroom participation but responded to 1:1 sessions with the teacher even though, teacher perceptions were that, generally, that they did not need help. Arabic girls were not a behavioural problem but were uncommunicative in the classroom even though they were experiencing problems, which was defeating for their teachers. Vietnamese were very passive and difficult to engage in the mathematics classroom and required help such as provided by mentor systems. Russian and Lebanese students preferred to work within their own ethnic groups which could cause disciplinary problems in the classroom. Cultural factors prevented Greek girls from having high expectations in their mathematics education. Comments in relation to culture and mathematics were highly varied and this variability is illustrated in the teacher perceptions below:

I felt unsuccessful with Greek girls. I noticed that remedial mathematics classes were almost all girls. This lack of success related to lower culturally based expectations of Greek girls (T19).

I use a lot of action, which includes movements e.g. applied to transformations in the form of modern dance. I believe that the migrants in my class who are mainly Italian and Spanish speaking are fortunate to have me as a maths teacher because, as a second generation Italian migrant, I speak their languages and understand their cultures (T27).

I allow the use of their own language in the classroom so that they are able to help each other. I simplify my language. I provide the format of report writing for them. I allow students to translate for each other and I use simplified notes. I explain mathematical terms in detail (T30).

(b) It has been noted earlier in this chapter that ESL was available for some teachers. However, in their perceptions of practice in their own classes, the majority believed that, it was necessary to take individual action in the area of language in mathematics and this ranged from language inclusive teaching strategies to careful choices of text-books and teacher notes. Small groups were used by three teachers one of which chose the students of the groups and changed their arrangements according to the mathematics topic of study. One of these teachers allowed the use of ethnic minority language but stressed that the groups were never allowed to become single nationality groups. Three other teachers also approved the use of ethnic minority language in class. Three teachers spoke of special care taken with language; two used mentor systems and gave 1:1 teacher-assistance. Other teachers contributed single strategies with the exception for two teachers who took no differentiated steps at all towards ethnic minority students. Their reasons for this were extremely diverse as can be seen in the following comments:

T5 was a retired teacher of ethnic minority origin who began teaching mathematics in Australia in the assimilationist period was committed to a teacher directed methodology where all students were treated in the same way. His response was simply:

Not relevant.

At the other end of the spectrum, T6 answered in terms of her experience and training:

I was a newly graduated student, still learning (T6).

In commenting on available texts teachers chose their own material from a wide variety of authors and publishers such as Nelson, Heinmann, Franklin and Preece, Fitzpatrick and Galbraith, Coroneos, Addis & Wesley, Lynch, Blane, McCauliffe, Evans, Mathematics for Australian Schools in the secondary division and Vital Practice Maths, Maths Plus and Victorian Signposts in the primary division. Three teachers issued their own notes and programs (T7, T11, T29) and one would have preferred to do so but did not have enough time. T17, born in Greece and teaching in a Greek school, commented:

Students want and need teacher notes but I have no time to design migrant directed materials (T17).

At least six of the teachers interviewed expressed dissatisfaction with the textbooks they were using. Only two teachers (T12, T30) expressed admiration without qualification. To elicit from them how their adverse comments about textbooks related to ethnic minority students, however, proved to be a difficult task for the researcher as some of their criticism was general rather than specific to ethnic minority students. The most common comment related to ethnic minority students concerned language and 'wordiness'. T6, working in the period of Mastery Learning in the 1970s commented:

SRA/Addis-Wesley were used. I perceived student boredom once the novelty wore off – in hindsight I cannot remember any interaction or games etc. Migrant success relied on reading ability. The material was suitable for Asian students but was very difficult for Southern European migrant students (T6).

I like McCauliffe, R series – because of its simple language and lots of exercises. I find Lynch is too hard for migrants – McCauliffe is user-friendlier (T30).

No distinction is made between student origins. Migrants must catch up, which they often do because they don't need as much English (in maths). For the Maltese, Arabic and Chinese students there is numerical context in their own words. The texts are all similar. I do not like wordy extraneous explanatory texts, which put things into distracting contexts – I like as little words as possible (T29).

We used Maths for Australian Schools 7-10 last year. It is better suited to CSF and has puzzles, codes and colours and is generally more user friendly and appealing. It refers to Asian examples and is better suited to Asians (T24).

VPM (Vital Practice Maths) and Maths Plus are used as resources – Vic Signpost Maths is used for specific areas – it has gaps – its revision of wide areas is not so good – ESL students use this one because the language is more appropriate (T26).



When questioned about the mathematical cultures which ethnic minority students brought to the classroom and the possible worth of any of these, only four teachers spoke of an interest in pursuing new ideas. T19's response to the question of adoption or discussion of any different methods ethnic minority students used in solving mathematical problems was typical:

No, I don't think so. I have not adopted any strategies in general (T19).

T24 noted different skills in ethnic minority groups:

I found migrant students were good with numbers but not so good with spatial problems and they found problem solving difficult (T24).

T7 and T11 made similar comments:

Through group work and exchange of ideas within groups different methods were revealed (T11).

T29 did refer to anecdotal material, as follows:

Yes – I used experiences of individual students. For example, an Iraqi student told us of his early education in Baghdad, then in Turkey for two years followed by one year in Canada. We discussed his experiences and those of his older brothers at school.

Finally T30, while not talking of ethnic minority mathematics culture referred perhaps to what he saw as “innate” migrant characteristics in mathematics learning when he said:

Yes – all the time. I look out for new strategies – technology has helped – migrants are generally keen and are helped in maths by new technologies (T30).

(c) Teacher perception and/or use of external professional development or in-service resources related to ethnic minority mathematics education, such as literature, meetings, training or short courses varied considerably and tended to again veer into general mathematics areas rather than activities specifically directed to ethnic minority students. Five teachers had not participated in ethnic minority directed activities. However, one of these, T26, the only primary teacher interviewed, referred to the high degree of individual care directed by her to ethnic minority students. The

following comments which related to ethnic minority students in mathematics were, in the main, extracts from more extensive responses about mathematics education in general.

T6, in relating her experience as a newly trained teacher in the 1970s, who later moved into the TAFE system, commented;

The school belonged to the MAV. However, as a first year student out, I felt left out of opportunities, for example, to attend maths conferences. I later moved to the TAFE system. In 1986 I found books by Jan Thomas, Rob Moore and Molly McGregor very helpful. I have since taught "Language of Mathematics" at TAFE level (T6).

I attended MAV meetings and conferences but can only remember attending comparative education activities which I found useful and interesting. In the 1980s our school tried to incorporate Asian education through immersion across all subjects and I attended some conferences and in-school meetings relating to this (T7).

The maths teachers at our school attended a course addressed to language and numeracy put on at Holmesglen TAFE (T12).

I have attended professional development courses related to migrant backgrounds mainly at MAV workshops. In the 1970s one of the December conference articles dealt with girls in mathematics which had indirect connections with migrant education. The 1978 MAV conference proceedings contained Language in Learning Mathematics (164, J. Courtney). I find Australia is very insular (T19). (This teacher then listed a variety of mathematics education journals and publications and is obviously extremely well-read in general aspects of mathematics education – researchers note.)

The school belongs to MAV. I attended a conference about a program which is about the recognition of the difficulties NESB students have, for example, literacy across the curriculum. This recognition is in the school's charter – it involves more time spent in reading and the belief that reading historical writing assists in language acquisition. We use brain storming to put strategies into practice (T24).

I cannot name them but I do read various publications and I attend MAV lectures (T30).

In conclusion teachers perceived the need for assistance to ethnic minority students in mathematics which they provided through recognition and consideration of cultural characteristics of the different ethnic minority groups in their classrooms. They supplemented this attention in different ways such as the allowance of the use of ethnic languages in the mathematics classroom, creation of their own instructional material differentiation between available texts which they deemed as generally unsuitable, appropriate groupings of students and extra teaching sessions. Several teachers attended professional development activities and lectures which, on the whole, were provided by the MAV and which were related in the great majority of cases to the problem of language in mathematics. TAFE courses also related to language were attended by two teachers. Only one teacher mentioned publications devoted to language of mathematics by Thomas, (1986) and McGregor and Moore (1991).

#### 6.3.4.4 Teacher perceptions of ethnic minority student attitudes, achievement and expectations in response to regulatory assessments

The perceptions of teachers of ethnic minority student response to regulatory assessment were largely related to VCE assessment. Within the environment of the classroom, the high degree of motivation of ethnic minority students was noted by eight teachers. Six of these perceptions related to "Asian" students and two to Russian students. Thus teachers were able to discriminate between ethnic minorities of different origin. Where comments were addressed to ethnic minority students in general the basis of comparison appeared to be the ethnic majority, described variously as "Anglo-Saxon", "Anglo-Celtic" or "Australian". The comments of T11 and T24 spoke clearly of this comparison as follows:

Asians are more ambitious and they are the hardest working students. They ask for extension sheets and seem to 'hunger and thirst' for work. This attitude is not present in Australian students (T24).

Migrants are generally highly motivated and "hungry" for knowledge – to "get on" they need to be good – it takes two generations to sink to Australian levels of motivation. I think their attitude comes from sharing ideas with family around the table. They do not have money for students to work in their own rooms (T11)

The Vietnamese students show different levels of achievement and motivation in different waves of migrations and generations (T12).

Vietnamese students are in two groups – the first group was very highly motivated but the second wave contains elements of apathy (T30).

I find that achievement patterns have changed over the years. In the 1960s there were many high achieving Italian students. In the 1970s and 1980s expectations in the Italian students and parental support for them were still high. In the 1990s there is less push from the parents and the achievements of students of Italian origin are more evenly distributed (T27).

The latter comment echoed the comments of other teachers about the importance of parental pressure as a component of motivation in ethnic minority groups.

Different reasons were given for the perceived high level of motivation of ethnic minority students, which some teachers felt, was not always innate. Family pressure was the most common reason.

A sample of perceptions of teachers relating to factors of motivation in mathematics included the following comments:

Migrant students are more motivated generally but their intellectual scale is similar to Australians'. However they are more inclined to stay in mathematics and a higher proportion do two maths at VCE level (T1).

Migrant student progress seems to be closely related to parental interest and also the expectations of peers of the same nationality give them confidence.... I find that migrant students often work harder than others (T26).

In contrast, two teachers spoke of culturally and socio-economically related barriers they had observed in ethnic minority groups. T26 commented on her own classroom situation and her own efforts to overcome what she perceived as gender specific disadvantages, where the progress in class of some ethnic minority girl students collided with the cultural expectations of their parents, as follows:

Cultural and religious expectations can also interfere with class work.... In all the nationalities I think (primary) education is geared towards girls but Muslim girls can be disadvantaged (by their culture) depending on which Islamic country they come from and also by their chronological position in the family. The first girl-children are the ground-breakers for younger sisters and there are restrictions placed on them.....they can have heavy family responsibilities as carers which interrupt their work. Their previous education can be very poor depending on the degree of Westernization in their country (T26).

T5, an ethnic minority teacher who endorsed the English model of teaching and its shaping by the universities in his colonial upbringing of the 1950s, spoke with some passion about the motivation of ethnic minority boys in the 1950s-1960s as follows:

Most young migrant boys were out to make money – they looked to marriage, a house, children - they had no confidence in school and believed that the system was against them (T5).

Finally, on the role of parents and the motivation of ethnic minority students generally, T17 implied that teachers of mathematics had internalized expectations of ethnic minority students, when he said:

There is an expectation that Asian students will be good and that their parents will push their children to succeed. European students are expected to be lazy but smart (T17).

However work effort and motivation did not always correlate with achievement in the perceptions of some of the teachers:

Four teachers (T1, T2, T6, and T29) did not perceive any differentiation between achievement results of ethnic minority and ethnic majority students. Four other teachers (T7, T21, T24 and T30) described the high achievement results of Asian students which included Chinese and Japanese groups. T27 compared the achievement levels of Italian students in the period 1960s-1980s with those of the

1990s. One teacher spoke of the difficulties a particular migrant group encountered in achievement, noting that his perception of logical thinking did not seem to connect with theirs. He described this situation in the following terms:

South Americans from places like Chile have culturally related problems in logic (T30).

T12 felt that the presence of ethnic minority students enhanced the general standard of mathematics achievement in her classroom. She also commented that while Chinese students were competent in skills, they did not have enough English language to present reasonable answers.

A sample of other comments describing these different viewpoints appear below:

I cannot generalize. Students achieve on an individual basis (T2).

I really could not separate achievements out (T6).

There is an assumption that all Russian students are good at maths but I know there is a mixture of ability (T1).

....at VCE (year 12) level each year, the Chinese origin and Japanese students achieved a higher mean mark than the rest of the students who were mostly of Anglo-Celtic origin. They (Chinese and Japanese students) did not necessarily achieve the highest marks but as a group their average performance was better. For example their mathematics scores were rarely below C level (T7).

Chinese students achieve best – their talents and attitudes make them highly successful. I adapt some Chinese methods. There are also some very good Italian students (T30 in reference to VCE results).

In conclusion, it would appear that teachers were well aware of the individual progress of all students within their mathematics classes. Within this knowledge some of these teachers were able to draw comparisons and to discriminate between different ethnic groups in certain attributes relating to assessment. More than half of

the teachers interviewed identified high levels of motivation in the ethnic minority student cohort and some referred particularly to the motivation of Asian and Russian students. Examples of perceptions alluded to parental pressure which played a key factor in high motivation of some ethnic minority students but which, for other ethnic minority students, hampered their progress in mathematics. Teachers were less committed to the idea of discrimination between ethnic groups in their perceptions of achievement. In the perceptions of the four teachers who did observe differences in achievement, South East and East Asian students were considered to be highly successful in their assessment results. Finally one ethnic minority teacher raised the possibility of preconceived teacher expectations of motivation and achievement of two large ethnic group categories, these being Asian and European cohorts, whose achievements in both cases were expected to be high but whose motivational attributes differed. This raised the question of whether teachers have reached a point of generalized preconception about ethnicity in their teaching of mathematics which, in the viewpoint of the researcher, would introduce serious ramifications into mathematics education generally.

Not all data collected as a result of the personal interviews were used in the analysis of teacher perceptions and the researcher's discretion was used to select responses. This selection, on the whole, was applied to perceptions common in principle to more than one teacher. The single comments used were identified as such and were related to collective responses or were of special interest. Some difficulties arose from the tendency of teachers, despite their roles as teachers of mathematics, to comment on general aspects of education rather than mathematics education specifically. Comments on learning difficulties in mathematics and resources employed by schools to correct these, were related to all students rather than to ethnic minority students. In both cases the researcher endeavoured to use comments specific to the experiences of ethnic minority students in mathematics. In the next section a table depicting these results will provide a summary of the findings.

#### **6.4 Summary of personal interview results**

Teacher perceptions of responses of mathematics educators at different levels, to the presence of ethnic minority students in the classroom are summarized in Table 30. Similar perceptions described by a number of teachers have been used as a basis of

this summary. Some significant individual comments have also been included at the discretion of the researcher.

**Table 30 – Summary of individual teacher perceptions**

	Teacher perceptions of government and sector responses to ethnic minority students in the mathematics classroom	Teacher perceptions of school responses to ethnic minority students in the mathematics classroom	Teacher perceptions of their classroom strategies in the mathematics classroom and the responses of their ethnic minority students
The school and classroom environment	<p>No apparent government/sector response was directed to mathematics of ethnic minority students.</p> <p>Within the three school sectors, Government, Independent and Catholic different selective philosophies and policies were directed towards the enrolment of ethnic minority students.</p>	<p>Different perceptions emerged. The school did not set out to attract ethnic minority students. Zoning and location were the main reasons for attendance at the school.</p> <p>The school set out to attract ethnic minority students of a particular ethnic background. These schools included a government school and two independent schools</p> <p>Ethnic minority teachers of the same ethnicity as their students felt that common ethnicity was an advantage in mathematics education.</p> <p>Ethnic minority parents endeavoured to send their children to schools of high academic reputation.</p> <p>In one example a government school was known by ethnic students in their own country before arrival and was recommended by the local Language Centre in Australia as a school for able mathematicians.</p>	<p>Recognition that different ethnic minority students from different cultures required different teaching strategies in mathematics.</p> <p>There is advantage in mathematics teachers having the same nationality/culture or, a good understanding of the culture of the majority of their students.</p>



Specialized staffing for language and other requirements.	<p>Help in BOTH English and the language of mathematics was needed.</p> <p>Generalized ESL help was provided in schools through government funding.</p> <p>Government funding response related to language resources was intermittent. In the 1970s &amp; 1980s- Liaison with Language Centres was available, also Consultants, videos, information sessions, publications emphasised the importance of language in mathematics.</p> <p>Ethnic minority teachers emphasized particularly the need for language help.</p> <p>One of the ethnic minority teachers noted that he applied for, but was not appointed to, government schools in ethnic minority areas.</p>	<p>Most teachers perceived that while ESL departments were present in schools they were unable to give much help to mathematics students. ESL was directed in most cases to literary subjects.</p> <p>Ethnic minority aides with mathematics experience were rare but helpful.</p>	Minority student learning is enhanced if the teacher or an aide in the classroom has some understanding of the structure and usage of their language.
Curriculum and pedagogy	<p>Teachers did not perceive any government advice or intervention on behalf of the ethnic minority in the face of considerable curriculum and pedagogical change in mathematics education.</p> <p>There was new emphasis on individualistic teaching in the 1970-80s. Language requirements especially in reading skills were higher.</p> <p>Ethnic minority students required more individual teacher time.</p> <p>Large classes were difficult to manage.</p> <p>The only primary teacher observed that different government schools varied their mathematics pedagogy and content to suit different ethnic minority populations.</p>	<p>All secondary teachers in the interviews perceived that mathematics was a high status subject where most students took mathematics to at least year 11 level. Its importance was increasing as an indirect result of the LAP test in primary education.</p> <p>Despite this importance ethnic minority students were often placed directly into mathematics classes on arrival while their introduction to other subjects was more gradual</p> <p>Random sampling or even spreading operated for placement of ethnic minority students into mathematics classrooms. 3 teachers described the grouping of all ESL students into one or two classes at each level and the failure of this system mainly through cultural conflicts.</p> <p>School policy kept the numbers in ethnically diverse mathematics classrooms mathematics too high</p>	Teachers in addressing a perceived need for assistance to ethnic -minority students <ul style="list-style-type: none"> <li>-allowed use of vernacular in the classroom,</li> <li>-supplemented unsatisfactory texts with their own material</li> <li>-used small group techniques</li> <li>-arranged extra teaching sessions</li> <li>-attended information sessions given by MAV and TAFE related to ethnic minority teaching</li> <li>-were unaware of publications on mathematics education for ethnic minority students</li> </ul>

Assessment	<p>CSF was made up of small parts with highly focussed assessment. Flexibility needed in assessment and reporting procedures for ethnic minority students were lost.</p> <p>VCE internal CATs had advantages and disadvantages for ethnic minority students – for some, cultural problems arose but for others independence created a good response.</p>	<p>Teachers noted high levels of motivation in ethnic minority students and identified different ethnic groups who worked particularly hard in mathematics.</p> <p>Strong parental pressure in some ethnic minority groups to succeed in mathematics</p> <p>In the 1960s education was not relevant to some ethnic minority students who left school as soon as possible to put all their efforts into earning money and improving the economic status of their families.</p> <p>In comments about achievement in mathematics teachers were divided. Mathematics achievement patterns of ethnic minority students were representative of all students in their classes and Certain ethnic minority groups were distinguishable from students in their achievement of high results. in regulatory assessments.</p> <p>One teacher noted that generalized expectations existed in teacher perceptions of mathematics achievement of various ethnic minority student groups.</p>
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## 6.5 Conclusion

As a final conclusion, teacher perceptions of response will be combined to describe the mathematics classroom.

### 6.5.1 *The school and classroom environment*

While the majority of teachers did not perceive government response directed to ethnic minority students in mathematics in particular, they perceived different responses on the part of all three sectors, Government, Independent and Catholic, to ethnic minority students in their enrolment patterns. The extremes of these selection procedures varied from active campaigning for the enrolment of students of particular nationalities and cultures to the enrolment of ethnic minority students based on zoning and the location of ethnic communities in the school neighbourhood. That at least one selection procedure was directly related to mathematics education was exemplified by one teacher, who described enrolment of an ethnic minority group at a particular school, because this school was known in their own country as a school for able mathematicians. Teacher perceptions of high achievement patterns of certain ethnic minority groups in mathematics education may have been an indirect factor in selective enrolment patterns of other schools. Certainly there was a general perception of teachers that ethnic minority parents endeavoured where possible to send their children to schools of high academic reputation.

Ethnic minority teachers employed in schools where the general ethnicity of students was related to their own, felt that this common ethnicity was a significant advantage in the teaching of mathematics. Thus teachers observed that different ethnic minority students required different teaching strategies in mathematics. For a significant number of teachers, an understanding of the cultural characteristics of ethnic minority students in the mathematics classroom, was a desirable attribute.

In Chapter 5 in the discussion of macro mathematics educational policy and management over the five decades of this study, it was found that the assimilation policy of the 1950s and early 1960s period of immigration allowed for little individualistic teaching of mathematics. It was not surprising therefore that two teachers working throughout this period saw the teacher centred classroom as an opportunity to give all students a fair and equitable chance to explore a mathematics which they saw as a purist discipline of some beauty. An individualistic approach in their mathematics classroom teaching was not an important issue. However in their opinion, they did not treat ethnic minority students as "invisible beings" in the social interactions of the class. They took steps to include various cultural references in their teaching particularly in the use of language and, in their own perception, were aware of and concerned with the post-compulsory destinations of their students.

#### 6.5.2 *Specialized staffing for language and other requirements*

In the years of transition and multiculturalism in which ethnic origins became more and more diverse teachers did perceive language difficulty. The provision of ESL teaching which was funded by the Federal Government in the last 20 years was designed, in theory, to assist all teachers in their various areas of the curriculum including mathematics. However, while important in improving the English language skills of students in the classroom, the mathematics teachers perceived that the ESL system only partially addressed the learning difficulties of ethnic minority students in the mathematics classroom. An understanding of the language of mathematics lay not only in the area of its specific terminologies and its differing numerical systems, but also in the precision and exactitude with which way it applied commonly used words such as prepositions. This sort of language understanding was seen by mathematics teachers as beyond the experience of many ESL staff who, on the whole, were teachers with humanities experience. Never-the-less they deplored the loss of

ESL facilities in the 1990s when funding cuts were applied by the government. Teachers found, however that teacher aides who had mathematics experience and who were of the same ethnic origin as a significant number of their students, helpful to those students. This scheme also provided some relief from time constraints imposed on teachers by a more individualistic pedagogy.

Thus teachers perceived that help in both English and the language of mathematics was needed. Some were aware also of schools liaisons with Language Centres and the availability of specific resources such as consultants, videos, information sessions and publications addressed to language in mathematics. It seemed that an understanding by the teacher and/or aide of the structure and usage of the language of ethnic minority students was a help to these students in mathematics. Teachers of the assimilation period of the 1950s and early 1960s however, believed that language was not a serious problem for NESB/ESL students because of the general similarity of mathematical ideas and terminology throughout the world.

Finally, one teacher asked if the employment of ethnic minority teachers to teach mathematics to ethnic minority students of the same ethnicity or culture was against the policy of the government of the time (1970s and 1980s). The answer might well be found partially in the Interim Report of the Committee of the Victorian Enquiry into Teacher Education, February 1980, in regard to Teacher Selection as follows:

15.11 While there is much to be said in favour of regarding persons of ethnic background as valuable potential teachers in this area, ethnicity ought not to be equated automatically with cultural affinity and understanding. Many people of non-English-speaking background have forfeited much of their cultural heritage in their efforts to achieve success in Australia and may not, in consequence, be any more receptive to the problems of non-English-speaking, ethnically different children than some Australians of monolingual, English-speaking background (Asche, 1980, 266).

### 6.5.3 *Pedagogy*

Different mathematical cultures which students brought with them to the classroom created pedagogical difficulties. In-depth treatment of particular topics in some

cultures, such as that of Russian mathematics, as opposed to gradual inculcation of concepts over several years in Australian mathematics education was one example.

Teachers approved in general of the individualistic character that Australia's mathematics education had assumed by the 1970s but noted that it created the need for pedagogical change and particular difficulties for some ethnic minority students. Teachers did not perceive any government advice or intervention on behalf of the ethnic minority as a result of changes in secondary education which introduced to pedagogy the methodology of mastery learning in the 1970s. The situation was perceived to be similar in the 1980s when a curriculum was introduced which included problem solving exercises and a changed pedagogy. As a result of these individualistic orientations teachers perceived increased language requirements in both reading and participation in class discussion. The importance which some ethnic minority students attributed to the achievement of the right answer was perceived by some teachers as in opposition to a higher Australian focus on the crafting of methodologies of logical problem solving. The latter constituted, as was shown in chapter 5, an almost 'sacred' direction of Australian school mathematics in the 1980s. The diffidence of some ethnic minority students in answering aloud or in discussing solutions was at odds with another Australian classroom mathematics characteristic, namely class participation in problem solving. Strategies for addressing these needs such as small group discussions, the writing of supplementary material, extra teaching sessions, attendance at information sessions provided by the MAV and TAFE, created extra demands on teacher time. Some teachers allowed students to communicate in their own languages in discussions related to problem solving to ease the burden of language difficulty.

Perhaps because these different strategies were required, the problems of ethnic diversity were made more difficult, in teacher perceptions, by the large numbers of students in their classrooms. Class sizes reported in the early 1970s as described by one teacher working at VCE/HSC level were certainly larger than the classes of the 1990s but the diversity of ethnic origins within them was not as broad. In the researcher's experience of observing mathematics classes in Indonesia, the average class size of fifty students was higher than the highest figures mentioned by teachers interviewed. While the content in the mathematics of classes resembled that of

Victorian schools at the same level, the method of teaching, while producing a high level of classroom interaction and a high level of individual involvement of students within groups, differed most markedly from Australian schools. The Indonesian teacher was at all times the central director of activities and as such remained at a distance from the students both in a physical sense and in the sense of his/her role as the professional supervisory expert. Singling out by the teacher of one student and 1:1 discussion within the classroom was not observed by the researcher. This style of teaching may perhaps relate to the diffidence of some ethnic minority students of Asian origin to speak to the teacher in the classroom as reported by several teachers in personal interviews.

In conclusion the individualistic pedagogical styles, particularly in problem solving exercises, which were promulgated by the mathematics educators in the decades of 1970s and 1980s and which were largely endorsed and practised by mathematics teachers, did not, in the perceptions of these teachers, elicit appropriate change in school structures and curriculum organisation in the face of an immigration policy which resulted in higher diversity in the ethnic origins of their students.

#### *6.5.4 Curriculum*

Secondary teachers noted the undoubted importance and status of mathematics in the curriculum of their schools, demonstrated by the allotment of time and the choice of most students to take mathematics as one of their subjects up to and including year 11 level. Some teachers also noted that, despite this importance, classes were generally large and in the placement of ethnic minority students into their mathematics classes, little attention was paid to language, culture and the previous mathematics education experience. This contrasted with the more literary subjects to which most ESL work was directed and to which ethnic minority students were admitted in a more gradual or staged fashion. This would seem to indicate that while teachers recognised difficulties caused by language differences and cultural factors in mathematics education, school curriculum administrators in general held the view that a universal and neutral character of mathematics excluded the need for consideration of these problems. This latter viewpoint has some resonance with the practice of mathematics education by two retired teachers in the personal interviews who worked in the 1950s and early 1960s and one who worked in a Catholic school in the 1970s. Within the

mathematics departments of schools different class structures were described by teachers, some of which were directly addressed to the mathematics of ethnic minority students. Confirmation of the importance of the connection between culture and mathematics education appeared when three teachers described the grouping all ethnic minority students together in one or two mathematics classes in a year level in their schools. This practice resulted in a delay of English language understanding and in enough culturally based conflict in the classroom for this practice to be abandoned in all three schools. Most teachers described the wisdom of either random or balanced placement of ethnic minority students in each mathematics class within each level.

According to the only respondent from the primary division mathematics had not assumed an importance equivalent to that of its place in secondary education. This lack of importance, she felt, was a consequence of poor mathematical skills held by primary teachers and a relevant lack of interest on their part. She noted also the variability of mathematics in primary schools and cited the more formal teacher centred mathematics taught in a school where there was a large cohort of Asian students which contrasted with another primary school where she felt skills were being depleted by a 'work at your own pace' teaching methodology. This raised the question of whether the presence of ethnic minority students had actually shaped some mathematics education in primary schools. She remarked however that the compulsory government imposed LAP testing in the 1990s had created an impetus to the recognition of the importance of mathematics in the curriculum by primary teachers.

What therefore did ethnic minority students reveal in their relationships with their teachers of their motivation and achievement in the face of changing ideologies of pedagogy, pragmatic and relatively unsympathetic mathematics curriculum implementation and teacher perceptions of the need to address cultural and language factors?

#### *6.5.5 Motivation and achievement of ethnic minority students*

Most teachers interviewed noted the high level of motivation of ethnic minority students in general and identified specific ethnic minority groups who worked

particularly hard in mathematics. Some teachers attributed this work effort to concentrated parental pressure. Where ethnic minority students left school early in the two immediate postwar decades there was pressure on them to establish socio-economic security for their families and the value of education was not obvious to them at this time.

In achievement teachers noted the superior numeracy of ethnic minority students generally but were divided in their perceptions of the academic success of ethnic minority students in regulatory assessment such as the VCE. The two most often expressed views were that there were no special patterns of ethnic minority achievement on one side and, on the other, that certain ethnic minority groups could be distinguished by their high achievement patterns. This latter view was taken one step further by a teacher, who perceived that an established culture of teacher expectation existed in relation to achievement patterns of certain ethnic minority groups. The implication of this expressed viewpoint perhaps is that some ethnic minority students required more help than others. Need however, both in the questionnaire responses and in the more detailed responses of the personal interview, was the driving force which shaped teacher attitudes to ethnic minority students in mathematics. On the whole, advantages and useful attributes brought to the classroom by ethnic minority students were not observed or put into practice. One example of this impressed the researcher. In some cases the mixture of ethnic minority students with ethnic majority students in a lower socio-economic communities discipline was seen as a problem. The most disruptive students were often ethnic majority students. However it was the quieter, more assiduous ethnic minority students, particularly those who had difficulties in class participation, which concerned the teachers and not the activities of 'spirited' ethnic majority. In terms of achievement generally, some teachers observed that some groups of ethnic minority students, were achieving superior levels in assessments but this did not appear to stimulate these teachers to analyze, emulate or promote this culturally generated expertise within the classroom. Their perception was that generally, ethnic minority students needed help and attributed any higher aptitudes to previous concentration on skill base through drill, a methodology with which they had no sympathy. Thus, teachers in this investigation adopted a personal responsibility for adaptation to ethnic diversity in mathematics education.



In personal interviews with teachers, the researcher did not record one reference to immigrants of Anglo-Celtic origin from Great Britain who were in fact, the largest immigrant group from a single country over the period. In the perceptions of teachers, they appeared to be totally subsumed into the ethnic majority Australian-born pre-immigration population.

Thus, teachers' perceptions seemed to emanate from two periods of pedagogy interwoven with two immigration policies. Although their pedagogy was bound closely to the use of classroom textbooks, most of the Australian-born teachers spoke of their interest in the arrival of understanding of mathematics in each student through an individualistic approach and through relevant real life problem solving. When there were many ethnicities in the classroom an individualistic approach was difficult. Ethnic minority students were disadvantaged and needed much attention. Large classes were difficult to manage. By contrast, teachers of ethnic minority students who had experienced classroom teaching overseas and teachers of the first wave of ethnic minority students in the 1950s approached mathematics teaching with a view to opening new ways of thought for which they had some reverence. In their view skills were necessary to appreciate and to delve into a way of enlightenment and to achieve understanding. While ethnic minority students warranted some individual interest, they could be taught satisfactorily in a teacher directed manner in larger classrooms.

However, in the last ten years of the period, the economic and technological progress of some nations, particularly those of South East Asia, in the 1980s have aroused international interest. Paralleled with this progress are the high mathematical aptitudes of the student populations of these countries, some aspects of which were illustrated in Chapter 1. Some of the teachers interviewed in this chapter expressed their concern about what they saw as a threatening, time-consuming and inappropriate invasion of numeracy testing into their teaching time. One primary teacher, however, approved of government-based LAP testing because she believed that it would galvanize primary mathematics teaching in general.

Thus, mathematics teachers have responded to the appearance of ethnic minority students in their classrooms in school based activities which have been extremely variable and have emerged in a highly personal way. In the perceptions of teachers Government directives or assistance schemes to the teaching of mathematics in ethnically diverse classrooms, outside the provision of ESL, itself non-specific to mathematics, have not been forthcoming. Teachers perceived that the lack of government intervention or regulation into the teaching of classroom mathematics, while not responding to difficulties in the teaching ethnic minority students, allowed them a certain autonomy in their classroom teaching. With the introduction of the CSF in the 1990s the degree of autonomy changed dramatically. Three teachers felt that the introduction of compulsory CSF curriculum and assessment disrupted the flow of individualistic teaching and, as a result, made the teaching of ethnic minority students even more difficult. In the perceptions of teachers VCE regulatory testing operating over the 1970s and 1980s contained within it elements which allowed some flexibility and teachers recognised advantages and disadvantages to ethnic minority students in its problem solving sections which were internally assessed. Certainly, in relating the most significant impacts in their periods of teaching, the majority of teachers cited the impact of government regulatory assessment. Perhaps, when considering their very personal responses to ethnic minority students within their classroom, their underlying concern related to their perceptions of the depth and breadth of their professional responsibility.

In Chapter 5 and 6 responses of the mathematics educators to ethnic minority students in the mathematics classroom have been examined from two different aspects. The first of these considered the intentional policies and management of the macro educators through the study of various government reports and documented implementations. The second described the work of a group of mathematics teachers in their classrooms through evidence gained from questionnaires and personal interviews. A study of mathematics teacher perceptions of response to ethnic minority students in their mathematics classrooms included the impact on their classrooms of policy and management of the macro educators, the impact of school policy on their classrooms and the impact of their own strategies and relationships with their ethnic minority students. In Chapter 7 conclusions will be drawn about the nature of the equilibrium between the responses found in mathematics macro

educator intentional policy and the responses perceived by mathematics teachers faced with classroom implementation in the environment of evolving immigrant change.

## Chapter 7

### *A synthesis of mathematics educator response*

In choosing the study of mathematics educator response in the last fifty years of the twentieth century as a basis of investigation in this thesis, the researcher was stimulated by an apparent constancy in ethnic minority student achievement in mathematics over these fifty years. The patterns of achievement and attitude of ethnic minority students in mathematics observed in the 1950s by the researcher as a student, were very similar to the patterns of achievement and participation at the end of the century observed in longitudinal studies of aspects of Year 12 education (LSAY Reports, 2000). Had nothing changed in Australia over the intervening years?

But there had been significant change in the student cohort over the years due to a very sudden, very large and very diverse post-war immigration program over fifty years which continues today into the twenty first century. In that time the ethnic minority which, in the 1950s consisted of a small number of mostly northern European immigrants, Latvians in the researcher's experience, changed to an ethnic minority in the 1990s which accounted for approximately one in four members of Australia's population and which was dominated by students of Chinese descent or cultural allegiance. How had Australia responded to these ethnic minority students in mathematics, which could account for these similar patterns of achievement and participation by ethnic minority students of such different ethnic origins?

#### **7.1 Revisiting some research findings**

Research led by Bishop in the 1980s and 1990s had reached the conclusion that quality teaching and learning of mathematics education was connected to the recognition and understanding of connections with the culture of its students. This research had been followed up by research into mathematics in the context of aboriginal education and government funding had been devoted to implementation of mathematics education by aboriginal teachers for aboriginal students. Had a similar a research program and implementation taken place in mathematics education in response to the presence of ethnic minority students in Australia as a result of immigration policy? The researcher could not find evidence of this except in the area

of language assistance. Since a connection with research could not be found, the researcher undertook to investigate any responses by the mathematics educators to ethnic minority students in the classroom.

## **7.2 Identification of mathematics educator control**

What mathematics educators were in a position to control and direct classroom policy and practice within the mathematics classroom? The investigation centred on two groups of mathematics educators, namely the macro educators who were responsible for intentional policies and their passage into the classroom and the classroom teachers who were responsible for the implementation of classroom mathematics education. Several difficulties arose in an investigation of their responses. These included:

- The complexity of macro educator documents which were issued both by federal and state governments some of which were contradictory and many of which did not represent direct responses but were interwoven with notions of disadvantages in other areas which crossed and intersected with responses to the ethnic minority in mathematics education.
- The choice of volunteer mathematics teachers through advertisement and the focus on their perceptions – while several primary teachers volunteers answered the preliminary questionnaire only one signified her willingness to participate in personal interviews. The attempt to question teachers about particular intervals of their teaching to achieve a balanced number of responses was difficult as their answers were not confined to these intervals and sometimes were not confined to mathematics.
- The choice of Victoria as a representative state in investigating state macro educator and teacher response was the only practical forum for the researcher to investigate the perceptions of response of teachers in the classroom. Writers such as Horwood (1997) and Clements (1989) described similarities between states. However Connell (1993) described differences in the educational structures of states. One teacher interviewed in the investigation noted that the most significant factor in his experience of mathematics education was the differences he experienced in moving from New South Wales to Victoria.

### **7.3 Relationships between the two groups of mathematics educators**

In Chapter 7 some conclusions will be drawn about the responses of two groups of mathematics educators in relation to ethnic minority students. As described in Chapter 4 these will be synthesized in the context of a balance between the intentional policies of the macro educators and their effects in the classroom and the implemented responses of teachers within the classroom. The tensions between these two groups of educators will be examined in relation to the major aspects of classroom used throughout this thesis which included classroom environment, language, pedagogy, curriculum and assessment. The catalyst of change was the changing nature of immigration policy which selected and admitted immigrant peoples through its own agenda of immigration policy. This background had changed dramatically over the period of study from an initial admission of immigrants of Anglo-Celtic background from Great Britain, to the admission of other Europeans, to the admission of non-European immigrants largely from the South East, South and East Asia, and finally to the admission of immigrants from virtually every continent in the world, which resulted in one of the most diverse populations in the world. Immigration in Australia had been carefully crafted through its entrance requirements to serve its own needs for stability and progress in the post-war world. Its immigration policies had included the admittance of some peoples for humanitarian reasons, but its eyes were firmly fixed on immigration as a means to fill shortfalls in its economic progress. In the first post-war years its heritage and culture remained close to that of Great Britain and this was reflected in its education system. However as the world embraced technology and market globalization its interest moved to the necessity to find a place in these events. Nationality, ethnicity and cultural connections were replaced by the need for expertise in business management and technology. Education, particularly attached to the systems of Great Britain and Europe, became more connected to the education of America and Eastern Asia. Australia also was beginning to explore its own identity as an independent nation and debates about republicanism emerged. It was looking to the marketability of its own education in other countries. Throughout these attitudinal changes mathematics had retained its important constituency in education.

What then were the underlying responses in mathematics to ethnic minority students? Could some explanation be found for the retention of ethnic minority students' superiority in participation and achievement in the 1950s and 1990s?

In seeking this explanation the researcher investigated the relationship between the control of mathematics education in the hands of the mathematics educators. What were the results of investigating the progress of classroom mathematics through the intentional policies and management strategies of the macro educators and the implementation of mathematics by teachers within the classroom?

### *7.3.1 Accommodation and teacher shortages in the 1950s and 1960s*

Chapter 5 described both the movement towards a more individualistic mode of teaching espoused by the Ramsay Report (1960) and the desperate measures taken by the macro educators to supply accommodation and teachers to the schools in the 1950s which continued into the 1960s. In relation to the responses of teachers, neither of the two retired teachers interviewed who taught in this period in Government schools, made any mention of any hardships. Both were very skilled mathematics teachers whose teaching styles were not aimed at students as individuals but to the 'good' of the whole class. One, while clearly a purist in mathematics, noted a need for discretion in asking ethnic minority students to answer questions in front of the class, and assigned any help needed or difficulty experienced, to the school pastoral care system outside the classroom. The other was of the Old Humanist school who spoke of the beauty of mathematics. Both had confidence in their own teaching and, in later decades of immigration and education change before their retirement, it is doubtful that either changed his mode of teaching although one moved into the Independent school system. The researcher recognized some affinity here with the interactive atmosphere within the very crowded, poorly equipped and teacher-directed year 12 mathematics classrooms observed in the schools of Indonesia (Jogjakarta), as part of a unit of study for a Masters Degree in Education (Monash University, 1991). The response relationship between the macro educators and these teachers in the assimilation period of teaching seemed to lie on the side of the macro educators who struggled to provide for the education of unforeseen numbers of students. For the two teachers interviewed who worked in this period it was 'business as usual' and a lack

of specific attention to ethnic minority students within a large teacher-directed classroom.

The perceptions of these two teachers however differed in a number of ways from those of the other fifteen teachers interviewed whose teaching was mainly clustered around the period between the 1970s and 1990s. The latter group of teachers, all secondary teachers with the exception of one primary teacher, was imbued with a 'terrier-like' dedication to individualism. Large classes did create difficulties for these teachers. The presence of ethnic minority students in the student population of their classrooms raised particular problems and stimulated the implementation of diverse and individual teacher strategies within the classroom. Teachers perceived also that to limit the extent of diversity was desirable and they noted that schools in all sectors had policies of enrolment which strove to limit this diversity. Chapter 5 described the individualism espoused in the policies of the macro educators over the period of study. How did the intentions of the macro educators of mathematics and the implementation of classroom teachers in the pursuit of individualism make connections with each other under the pressures exercised by varied immigration policies? The individualistic nature of macro education policy which appeared by the 1970s and 1980s, seemed to be complemented by the individualistic teaching on the side of the implementing teachers. How then was individualism fostered for ethnic minority students within mathematics education?

### *7.3.2 Individualistic pedagogy in relation to ethnic minority students*

All 17 teachers interviewed, in responding to the question of whether they knew of macro educator response emanating from government or sectoral sources to ethnic minority students specifically in relation to mathematics education, was that they were unaware of any such response at all. The individualistic treatment by fifteen of these teachers in the mathematics teaching of ethnic minority students from the 1970s and 1990s therefore, did not appear to have been generated by macro educator forces. Yet, in Chapter 5 individualism was a constant presence in the policies of the macro educators throughout most of the period of study, beginning with the generalist Ramsay Report in 1960, the endorsement by ACER, a government instrumentality, of mastery learning techniques in the mathematics of the 1970s, the multicultural rhetoric of curriculum policy documents of the 1980s (Ministerial Paper No. 6, 1984)



and the diagnostic aspects of curriculum and assessment of the 1990s (Profiles 1991-3, CSF, 1995). Why then, in the perceptions of the mathematics teachers, was there no translation of these macro policies in relation to the mathematics education of ethnic minority students?

#### 7.3.2.1 The ethnic minority in mastery learning

The practical management of macro education policies was the responsibility of the bureaucratic educational institutions of each state (Horwood, 1997). Mastery Learning of the 1970s, while not a compulsory direction imposed by the macro educators, was never the less advocated by them through the recommendations of ACER. This was an extreme manifestation of individualism which later became discredited. Perhaps this accounted for the lack of reference of teachers to this period. However within this highly individualistic teaching pedagogy no evidence was found that the needs of ethnic minority students in mathematics were addressed. However a study of circumstantial evidence related to the learning patterns in mathematics of students of Chinese origin, who were a large component of ethnic minority student cohort at this time, suggested that there were inadvertent opportunities for these students. There was dependence on English reading ability, an attribute that most of them possessed. Industry and self-motivation were useful attributes. Together with these, the ability to discuss problems in one's own language in the informal groupings of Mastery Learning and the availability of 1:1 student-teacher consultation were all factors important to students of South-East and East Asian origins as described by such writers as Leung (1989) and substantiated, as will be seen later, by the comments of teachers interviewed about ethnic minority characteristics in mathematical learning. The disadvantage however to ethnic minority students as described by Clements & Ellerton (1996) was the impoverishment of English skills for the senior levels of secondary education mathematics when more than just reading skills were essential.

#### 7.3.2.2 The ethnic minority in the years of multiculturalism

The most overt policies of the macro educators in relation to the education of ethnic minority students came with the recognition of multiculturalism in the 1980s as a result of which a plethora of educational papers and reports appeared. The Ministry of Education (Schools division) Victoria published in 1988, *A Mathematics*

Framework P-10, in which there was no emphasis on the mathematics education of ethnic minority students although there was a section devoted to the mathematics education of girls.

In policy documents there was also clear expression of the need to be aware of and to value the previous educational experience which ethnic minority students brought with them into the classroom (Ministry of Education, 1986). In neither the advisory curriculum instructions of the mathematics educator managers or in the responses of interviews of the teachers interviewed was there any evidence of this being implemented. The practical connection between the rhetoric of policy and the practice of management and practical implementation in the classroom had not been made. In the equilibrium between macro educator response and teacher response, despite the individualistic policy rhetoric of multiculturalism the teachers were responsible for specific measures in mathematics directed towards the mathematics education of ethnic minority students.

### *7.3.3 Language – contradictory responses*

As early as the 1950s the need for English language skills in mathematics was recognised (Clarkson, 1991) and in the 1960s the macro educators recognised the resultant stress on teachers created by large classes where the majority of students were of ethnic minority origin. But the macro educators were slow to respond in the period of assimilation. The formulation of policy and management and consequent funding of resources did not result in readily available language assistance to teachers until the 1970s and 1980s in the periods of integration and multiculturalism. Even after the provision of these resources teachers perceived that, while ESL departments in schools could supply trained teachers to assist in helping individual students to understand the question, they lacked mathematics expertise and a knowledge of the specific language requirements of mathematics and this limited their usefulness. Teachers noted that ESL assistance was intermittent and sometimes unavailable but deplored a cutback of government funding for ESL which they perceived in the 1990s – presumably ESL assistance was better than nothing. Other language resources also became available to mathematics educators in the 1970s and 1980s in the form of literature, videos and in-service activities added to the effectiveness of this assistance.

There was little evidence, however, in their responses, that teachers were aware of these resources.

Finally, mathematics teachers noted that the learning of mathematics was enhanced when they or an ethnic aide had some understanding of the language usage of their ethnic minority students. However, the use of ethnic minority teachers in the classrooms where students were of a similar ethnic or cultural origin students had been discouraged in a teacher training report (Asche, 1980). One ethnic minority teacher interviewed spoke of his inability to be appointed to anything but Anglo-Celtic ethnic majority schools in the government system despite his applications to schools with substantial ethnic minority enrolment. A number of teachers spoke of the usefulness of ethnic minority aides in the mathematics classrooms of the 1980s and 1990s. Some teachers were able to make connections with local Migrant Centres where these were in proximity to their schools.

The sides of the interaction of macro and teacher responses seemed to be pushing in opposite directions. ESL was provided increasingly by the macro educators but within this, the special requirements of mathematics were not understood by ESL teachers. Education resources were available but were not reaching the majority of teachers interviewed. On the other side of the equilibrium, ethnic minority mathematics teachers and aides with some expertise in mathematics were seen by the teachers interviewed as useful elements in mathematics teaching of ethnic minority students but up until the report (1980s) this was not approved by the mathematics educators. ESL help, however, was able to provide some help.

#### *7.3.4 Curriculum change and the ethnic minority*

The most lasting change in curriculum in Victorian mathematics education was the introduction of problem solving in the 1980s. In the previous section it has been seen that the Frameworks documents of the 1980s did not include attention in mathematics to the ethnic minority students of mathematics. However a major emphasis was placed on the inclusion of problem solving in mathematics courses at all levels in the same publication. A whole chapter was devoted to problem solving which included in an explanation of its nature the following words:

Problem solving activities bring together the interest and usefulness of mathematics in applications which build on students' own experience, using fantasy or real settings for creative investigations into non-routine problems (Ministry of Education (Schools Division), Victoria, 1988, 46).

Group work was the subject of the next chapter of this publication which involved "students working together and learning from each other" and this was applied to examples of problems. No reference in these chapters was made to ethnic minority students.

The introduction of mathematics problem solving, an activity of which most teachers interviewed approved, appeared to create an effect of shock among some ethnic minority students. The predominant ethnicity at this time was again South East Asian and East Asian. These students found themselves directly placed in mathematics classes but not in literature based subjects. Their arrival 'cold turkey' in mathematics classes created difficulties for teachers. They required and demanded individual help. Behind their demands were the high expectations of their parents who were also unused to the problem solving approach. Large classes were difficult to manage. Teachers found textbook material unsuitable and had to prepare notes and stepwise instructions. The need for all students to contribute as individuals and to learn from each other revealed some sensitivities. English skills required in writing up and oral discussion were more exacting than previous activities. Aspects of problem solving were included in HSC Options and internally assessed VCE CATs and these required clear explanations of methodology and argumentative writing. A correct answer as required in 'pencil and paper tests' was not necessarily the major achievement measure. Teachers spoke of the absence of intervention by the State Government authorities which would assist in teaching this curriculum to ethnic minority students. Some teachers however were able to attend information sessions organized by the MAV and TAFE institutions. There were varying opinions expressed by the teachers interviewed about the success of ethnic minority students in problem solving. Some teachers described diminished achievement, while others felt that, despite difficulties, ethnic minority students were able to achieve at a high standard. The teaching of problem solving to ethnic minority students therefore contained within it specific challenges to teachers which were not present for ethnic majority students.

Response to ethnic minority students in this area was clearly in the domain of the implementing teacher.

### *7.3.5 A dichotomy in perceptions of standards*

In the 1980s when a number of disadvantaged groups in education had been identified largely as a result of the Galbally Report, the ethnic minority group of students was classified as disadvantaged. This related closely to their lack of English speaking skills, the lack of recognition of the attributes of their cultures in the immigration policy of assimilation of previous years and socio-economic and other hardships suffered by those who had arrived in Australia for humanitarian reasons. The macro educators, in education policy rhetoric recognised the disadvantage of language skills in English but at the same time extolled the contributions that ethnic minority cultures and educational experiences might contribute to education in Australian schools. As discussed earlier in this chapter, in the manifestation of macro education rhetoric in the mathematics education implemented by the agencies of macro educators in Victoria, these contributions evinced no discernible response in mathematics although in several other school subject areas such as Music, Literature, Art, LOTE such aspects transformed the curriculum of these learning areas. Any disadvantage in mathematics related mainly to English skills which were being addressed. As was described earlier the majority of teachers interviewed perceived a broader range of disadvantage based not just on English skills, which they saw as inadequately provided for mathematics teaching, but also on cultural difference. In Chapter 6 teacher responses indicated the need also to respond to cultural conflicts within mathematics classes and they were involved in the restructuring of administration structures which were addressed to this problem. The majority of teachers but not all of them therefore generally perceived the need to address disadvantage within the ethnic minority cohort and they devised a number of individual strategies to do so. A small minority of teachers in the questionnaire and personal interviews perceived that ethnic minority students required no assistance in mathematics at all.

In the 1990s when the Curriculum and Standards Frameworks (CSF) was made compulsory by the macro educators, this was the result of concern on the part of mathematics macro educators about what they saw as slipping standards in the numeracy and basic skills aspects of mathematics education. There was some

evidence of macro educator interest in the mathematical standards of China and connections with American research (Stigler & Baranes, 1988 and Cheng, 1995). Research in Australia was commissioned as a result of similar concern about mathematical standards in Australian classrooms (Chuangshen et al, 1996). Several teachers interviewed still perceived a disadvantage of ethnic minority students and alluded to the disruption caused by the CSF which interrupted the flow of individualistic teaching. Teachers were divided equally about the achievement of ethnic minority students in regulatory testing at the end of year 12 of secondary education. Half commented that there were no trends in relation to ethnic minority or majority students and half perceived superior results achieved in mathematics by students especially of Chinese ethnicity and or culture. One teacher perceived a higher rate of participation of Russian students in year 12 mathematics, most of these students taking at least two mathematics at year 12 level. Finally teachers noted the attributes of motivation, industrious work efforts and parental support of ethnic minority students. Perhaps this work ethic was an incentive to teachers. However, control of mathematics education was now in the hands of the mathematics macro educators but whether this reflected response to ethnic minority student success in mathematics is debatable. This response, however was almost certainly a response to the standards of ethnic majority students. Most of the teachers interviewed still perceived disadvantage to be addressed in the progress of the ethnic minority in mathematics. One teacher only, in the personal interviews spoke of an interest in and sometimes the use of Chinese material in his classes. No other teacher expressed an interest in employing mathematics methodologies brought to the classroom by ethnic minority students. Within the questions of standards there appeared that contradictory viewpoints were held by the mathematics educators.

Where then did responses of mathematics educators to the ethnic minority students in mathematics education find their greatest expression?

#### **7.4 A summary of results**

It can be seen in the results above that responses of the two mathematics educator groups investigated interlocked in different ways. In some cases one group made responses and the other did not. In other cases both made responses which were complementary. Contradictory responses were also made by these groups.

A summary of these responses reveals the presence of all these variations:

- Responses through policy and its application of the macro educators only.
- Responses through teacher strategies within the classroom only.

These responses have been summarized in Table 31:

**Table 31 – One way responses to ethnic minority students**

	The macro educators	The classroom teacher
The mathematics classroom environment	<u>1950s, 1960s</u> Efforts made by macro educators to provide accommodation and trained mathematics teachers to redress unforeseen shortages due to immigration policy. Simultaneous introduction of individualistic teacher instruction and new curriculum content.	Retention of purist attitudes to mathematics. Teacher directed instruction which did not recognize ethnic minority students and was in accordance with immigration policy of assimilation at this time. Size of class not significant.
The ethnic minority and mastery learning	<u>1970s</u> Circumstantial evidence that mastery learning addressed aspects of culture which were utilised by ethnic minority students within its characteristics of individual and independent progress. An outcome at the end, however, was impoverished English skills.	Mastery learning a matter of choice in schools and classrooms. Little reference made to it in teacher responses.
The ethnic minority and the recognition of multiculturalism in education.	<u>1980s</u> Macro educator rhetoric which supported an inclusive curriculum and which acknowledged the ethnic minority and the attributes brought to the classroom by ethnic minority students. A lack of reference to these policies to mathematics education in Frameworks and other documents.	Individual teacher strategies directed to the needs of ethnic minority students in mathematics. These strategies designed to address teacher perceptions of disadvantage.
Curriculum reform in the 1980s. Problem solving in mathematics	<u>1980s, 1990s</u> A strong emphasis placed on problem solving begun in the US but which gained an enduring place in mathematics education of Australia. The inclusion of aspects of problem solving in regulatory assessment in Victoria. A methodology which related closely to ethnic majority culture. No macro response to its unfamiliarity in ethnic minority cultures.	Teacher support for problem solving but concern about its cultural unfamiliarity to ethnic minority students. A response to these students in the form of special resources such as increased P.T. time, special notes, stepwise instructions for ethnic minority students. A range of opinions expressed about ethnic minority achievement in problem solving.

Table 31 indicates responses to ethnic minority students which came from either the macro educators or the teachers in the mathematics classroom. But there were areas where both parties made responses. These included the following:

- Complementary responses in both intentional policies and their application and through teacher strategies
- Opposing responses between intentional policies and their application and teacher strategies. These responses can be summarized in Table 32:

**Table 32 – Contradictory and complementary responses to ethnic minority students**

	The macro educators	The classroom teacher
Individualistic teaching – a complementary response	A general policy of mathematics teaching to the individual student which included mastery learning, problem solving and the implementation of the CSF.	Classroom strategies to address the needs of individual students including ethnic minority students. Large classrooms difficult to manage. A recognition that the more ethnically diverse the classroom is, the more difficult the teaching of mathematics becomes. Use of schools in all sectors of selection devices to minimize ethnic diversity.
Language and the ethnic minority students – a contradictory response	The provision of ESL resources but an insufficient training of ESL teachers in the special language requirements of mathematics. A policy of not placing ethnic minority teachers with ethnic minority students. Some provision of resources for mathematics teachers such as books, videos which had not reached the majority of teachers interviewed.	A perception of teachers that ethnic minority aides with some mathematics experience were useful in mathematics and the perception that teachers and/or aides in the mathematics classroom were advantaged by an understanding of language structures of their ethnic minority students. Some teachers attended sessions conducted by MAV and TAFE Colleges.
Perceptions of disadvantage and assessment requirements of the 1990s – a contradictory response	A response to language disadvantage concerned mainly with English language skills. A concern with numeracy standards more related to ethnic majority students. Published surveys which indicated year 12 success of ethnic minority students in mathematics. Close ties with American research which was concerned with a perceived superiority of Asian school mathematics. Imposition of CSF in Victoria which presented a curriculum monitored by diagnostic testing and reporting	A response to broader definitions of language disadvantage in mathematics and disadvantage associated with cultural differences and cultural conflicts in mathematics education. An ambivalent attitude to ethnic minority achievement. Some teachers perceived no factor of ethnicity or culture present in student achievement. Others saw superiority in mathematics achievement of ethnic minority students particularly of students with Chinese descent or cultural heritage. A resistance on the part of some teachers to the CSF who found disadvantages to ethnic minority students within its segmented structures.



### 7.5 Concluding remarks

Thus the presence of ethnic minority students in the mathematics classroom of the two bodies of mathematics educators investigated, the macro agencies of response and teacher perceptions of response within the classroom, sometimes came from one but not the other, were sometimes contradictory and sometimes complemented each other. Some of these responses to ethnic minority students were difficult to separate from generalistic response addressed to disadvantage of both ethnic minority and in the end ethnic majority students. No evidence emerged of direct intervention by the macro educators or of advice documents issued in the public domain in Victoria to mathematics teachers except in the area of language where ESL departments were available to mathematics and where resources were available.

Research which connected to the role of culture in mathematics was not extended to implementation in schools and classrooms for ethnic minority students in the same way as it had been for aboriginal students. The extent of diversity within the ethnic minority student cohort created difficulties. The location of schools in ethnic minority neighbourhoods was the main determinant of diversity. Schools in all three sectors made efforts in different ways to overcome the difficulties of this extreme diversity. The establishment by specific ethnic minority communities of ethnic minority schools based on cultural and religious values was one response in the independent sector. There was evidence that the findings of research in relation to the cultural dimension of mathematics education had been recognised earlier than their publication, by teachers in the classroom who did implement individual responses to ethnic minority students in the mathematics education. This response took the form of a perception of cultural disadvantage of these teachers and they took steps to overcome these disadvantages. Confidence in their own methodologies of teaching in this mainly Anglo-Celtic contingent of teachers, which sprang from their own experiences did not raise the possibility of superior methodology in ethnic minority countries of origin, and they paid little attention of the cultures of mathematics which students brought to the classroom. Their enthusiasm in relation to problem-solving techniques demonstrated an Australian ethnic majority cultural affinity. The rhetoric of the Victorian macro educators about multiculturalism and inclusiveness in education did not extend to its inclusion in mathematics documents but did endorse

the problem-solving dimension in mathematics education. In the final analysis what were responses made to the ethnic minority students and from what mathematics educators did they emanate?

In conclusion, the researcher recognized that, while responses were difficult to isolate in their own right, two implementations of response were significant. The first was the recognition within the group of Victorian teachers of the role of culture in education, begun before research findings were published, to which they directed a response based entirely on their professional attitudes they held in relation to their own expertise. The second was the later recognition of the macro educators of the students rather than the structures of education, and as a result of this recognition, investigations of the particular attributes which ethnic minority students brought to mathematics education in Australia's classrooms.

#### **7.6 Today and tomorrow**

The intentional policies of the macro educators and the strategies of response of individual teachers manifested in the mathematics classroom were not always complementary. Has the situation improved in any way today? It seems that, in 2001, Australia will continue to accept immigrants. Moreover there is now tremendous pressure being exerted on Australia, by people fleeing from multiple countries where political regimes are repressive or unstable, to accept migrants who have not gone through the legal requirements of entrance. Australia has always carefully monitored the entrance of its immigrant people, most of whom have been admitted in response to specific shortfalls in Australia. In the face of pressures in the world can this selectivity persist? It seems probable that immigration policies could undergo change which will have ramifications for Australia's mathematics classrooms of the future. Such questions will have to await a later analysis. The researcher feels, however, that there is a lesson to be learnt in this study of the tensions between the policies and practices in mathematics education for ethnic minority students and that such studies can only enhance Australia's mathematics education. Better communication and shared endeavour between the mathematics educators, between research and practice in mathematics and between mathematics education and immigration policy would seem to be a priority in future years.

## Appendix A

The questionnaire insert in the "Common Denominator"  
(MAV Publication July 1997)

### Fifty years of Teaching School Mathematics in Ethnically Diverse Classrooms

*My name is Sue Wotley. I am a PhD student at Monash University (Clayton) in the Faculty of Education. My supervisor is Professor Alan Bishop. My study concerns the response of mathematics educators both at government policy and at individual school levels to the presence of significant numbers of migrant students in their classrooms over the last fifty years. My interest in this area has been stimulated by research which has shown that cultural factors play a vital role in the learning of mathematics.*

*As part of my own research I wish to explore the experiences of teachers of school mathematics during this period: primary and secondary, currently teaching and retired. Of particular interest are the responses of teachers working in the immediate post world war period and later in the 1970's and early 1980's, teachers who were themselves migrant students and teachers whose classrooms have contained a high proportion of migrant students in the last fifty years. I would appreciate greatly your responses to and expressions of interest in the short questionnaire below which can be mailed back to me using the address or fax number shown below. Please note that no findings will be published which could identify the participants, and that access to the data is restricted to my supervisor and myself.*

Please send your answers to this Questionnaire to

Susan Wotley  
Faculty of Education  
Monash University (Clayton Campus)  
Wellington Road  
CLAYTON 3168  
Fax: 9905 3668

1. Please circle the most common levels at which you have been teaching school mathematics over the last 50 years.

Year    1        2        3        4        5        6        7        8        9        10       11  
         12

2. Please circle the year periods during which you have been teaching school mathematics:

1940-49        1950-59        1960-69        1970-79        1980-89        1990+

3. Please identify the system where you have done most of your school mathematics teaching:

Government        Catholic        Independent        Overseas

4. In what country did you first go to school?.....

5. Is English your first language? yes/no. If the answer is No please specify your first language.....

6. What languages other than English can you speak, read or write?.....

7. Has your school mathematics teaching taken place mostly in

Metropolitan schools    Large rural schools    Small rural schools    Remote schools

8. Over the period 1940 to 1990+ please estimate the proportion of migrants in your mathematics classrooms and name the most common nationality of these migrant students.

<10%      10-30%      31-50%      51-70%      >70%

Most common nationalities.....

9. What resources were provided at the school as a specific response to the needs of migrant students in the mathematics classroom - do not confuse these with resources designed for students with general learning difficulties.

Tick any of the following which might apply and use the space below to comment on or to describe any other resources.

- ☐ Opportunities for you to attend courses or information sessions outside school.
- ☐ Provision of documentation from some expert source.
- ☐ Withdrawal of students from the classroom for specific help.
- ☐ Employment of migrant language aides in the classroom.
- ☐ Employment of English language aides in the classroom.
- ☐ Meetings/information sessions arranged with parents.

Other. Please describe

.....  
.....  
.....

10. What strategies did you personally devise to assist migrant students eg provision by you of different material such as simplified notes, examples etc.

.....  
.....  
.....

Please use the space below if you wish to comment further on your answers.

.....  
.....

Would you be willing to be interviewed briefly as a follow-up to this questionnaire? If so please indicate below your contact particulars.

Name:.....

Telephone: (BH).....(AH).....(email address).....

Thank you for your participation in this project.

Sue Wotley

## Appendix B

The format of personal interview questions,  
explanatory statement and consent form.

### **Outline of Questions to be used in Personal Interviews with volunteer respondents as follow-up of Questionnaire entitled**

#### **"Fifty Years of Teaching Mathematics in Ethnically Diverse Classrooms"**

(This questionnaire was inserted in the publication "Common Denominator" which is  
circulated to all members of the Mathematics Association of Victoria. Respondents were  
asked to indicate their willingness to take part in further brief interviews.

In the personal interviews further information is sought from teacher respondents with respect  
to their perceptions of the responses of different sections of the school education community  
to the presence of migrant students in mathematics classrooms. These sections are as follows:

- A Government Response**
- B System Response viz Government, Catholic and Independent school systems**
- C School responses**
- D Teacher responses**
- E Student responses**

#### **A - Government Responses**

What changes in government policy, with regard to the teaching and learning of mathematics  
education over the last fifty years, have impacted on you in the classroom eg the change from  
teacher directed classrooms in the beginning of the 1970's to open classrooms which  
emphasised more individualistic teaching and learning later in that decade or the changing  
nature of VCE mathematics fields of study and assessments over the period of the study?

Have these changes affected your teaching of mathematics to migrant students?

Are you aware of implementations of government policies, particularly in the area of  
mathematics, which have been directly or indirectly addressed to the factor of migrants in the  
classrooms eg training for teachers, recommendations related to text books and course  
materials, extra funding for schools with high migrant student numbers?

Has the emergence of different government-initiated course materials such as Frameworks,  
National Guidelines, VCE Courses of Mathematics Study caused you to change your  
approach to the teaching of mathematics to migrant students?

**Depending on the length of mathematics teaching and the year levels taught by the  
teacher responding, questions will relate to teacher awareness of**

\* the changes in government policy with regard to mathematics curriculum and assessment  
experienced by the teacher at (a) primary, (b) early secondary, (c) VCE levels  
over the relevant period of teaching

\*the reasons for change and if these reasons were linked with the rising numbers of migrant  
students in the classroom

\*available information about school mathematics courses at different age levels taught in countries of birth of migrant students and parents or assessment details which compare achievement levels of these countries.

\*any teaching or learning problems with migrant students which arose as the result of introduction of government-initiated new courses or assessment models into the classroom.

\*any government sponsored facility which offered specific help for teachers with large numbers of migrants in the mathematics classroom.

### **B - System (Government, Catholic and Independent Schools) Responses**

Are you aware of any policies or strategies put in place with respect to migrant education in the particular school system in which you work eg is the catchment area for students at your school designed to attract particular migrant groups?

Does staffing of the schools in your system reflect the origins of students at the school?

Does your system contribute resources, as a result of general policy, to the teaching of mathematics to migrant students?

Are there any sort of mathematics scholarships or incentive schemes offered or recommended by your system to assist migrant students to extend their schooling?

### **Questions relate to teachers' awareness of**

\*resources provided by the system to assist the schools in their educational programs where there are significant numbers of migrants; in the case of mathematics - written material, testing material, increased staffing, special departments within the school, provision of staff speaking the major language of migrants within the school, related staff training, staffing to run culturally based groups such as clubs, involvement of parents in the general activities of the school or in the mathematics classroom.

\*a policy of a suitable ratio of migrant students to Australian born students and the reasons why this figure has been arrived at.

\* link ups of schools in order to provide orientation and/or English language courses either on your school premises or by institutions outside the school, which are used in general by your system.

\*scholarship or incentive schemes operating in the system which assist students of migrant origins to stay at school and complete their educations

### **C - School responses**

What do you know of the reasons for the presence of migrant students in your school eg are they more related to the location or zoning of your school, to ethnic or religious characteristics such as Greek or Catholic Schools and/or to any other factors?

How important is the subject mathematics in your school curriculum eg to what level is the study of mathematics compulsory ?

Does the school modify its general curriculum for migrant students and if so, how does the study of mathematics fit into these modified programs?

Are migrant students distributed evenly through class groups or do they tend to be grouped together or does a combination of these strategies or any other strategy operate?

**Questions relate to teachers' perceptions of**

\* school policies related to migrant intake whether the school was obliged by zoning to take in migrants or whether there was choice and, in the latter case, their perception of what criteria formed the basis of this choice. In the area of mathematics in particular questions will relate to

\* importance of mathematics as a subject in the school and the proportionate allocation of staffing and time to it together with the level to which it should be compulsory for all students

\* what degree of difficulty the school assigns to the study of mathematics by migrant students in general, in comparison with other subjects, and the consequences of this in the academic program of these students.

\* what devices the school uses to place students in the appropriate class levels eg does it use diagnostic testing, interviews (parent, student, staff), school reports from previous schools if available?

**D - Staff Responses**

Tell me something about how you deal with the presence of migrant students in your mathematics classes.

Have you experienced problems eg does the language of word problems present special difficulty for non-English speaking migrants?

Have you felt the need for assistance?

Can you give me an example of a strategy you have devised specifically to assist you in teaching mathematics to your migrant students.

What do you like about the particular textbooks you use in the classroom?

Has your school put into place any programs which assist migrant students in mathematics eg teacher aides in the classroom or withdrawal into special groups.

Has your Mathematics Department devised strategies such as streaming or setting which relate to migrant students learning?

Have you used any external resources such as literature or attended courses related to migrant education?

**Questions relate to the specific responses of teachers with migrant students in their mathematics classrooms both through collegiate teaching resources such as schools Mathematics Departments, Special Education/Remedial Departments or any other relevant bodies available in that school and also by devising their own strategies in teaching mathematics migrant students. Teachers will be asked to comment on availability and/or use of**

- \* training resources such as inservice opportunities, visiting experts to the school, published material, advice from bodies such as the Mathematics Association of Victoria.

- \* human resources such as mathematics aides, language aides, withdrawal to language or mathematics classes, orientation programs, pre diagnostic mathematics testing

- \* structural responses such as streaming or setting devices of mathematics classrooms, different types of mixed ability groupings, related changes to class sizes, different prescribed texts, different mathematics curriculum.

- \* personally devised strategies such as own written material or teaching devices, modification of achievement testing, extra coaching classes.

### **Section E - Student Responses**

What impressions have you gained of the relationship between the students of various different origins, between these students and yourself and between these students and the Australian students in your mathematics classes eg do they group together and discuss problems in their own language, do Australians help with English or act as mentors, are migrant students able to ask many questions and participate in class discussion ?

Is it important or helpful to you and all the students in your mathematics class to know something of the cultural background of your migrant students? Equally is it important for the migrant students to know something of Australian culture in relation to mathematics ?

What is your perception of attitude and achievement of migrant students in your classes?

Do you know if they tend to continue their studies in mathematics beyond compulsory levels?.

Do you know if they study mathematics in after school coaching situations or in ethnically based Saturday schools or schools conducted after hours?

Have you ever adopted or discussed in classes any different methods they use in the solving of mathematical problems?



### **Questions will relate to teacher**

- \* awareness of some characteristics of migrant students communication both in their own language and in English, verbally and in written form, in school and out of school
  - \* perceptions of relations especially between students and between student and teacher which include common working strategies used in mathematics such as ability to participate in class discussion, ask questions, work independently, in groups or with student mentors
  - \* strategies to acquaint the class with cultural background of migrant students and the migrant students with the culture of Australia in relation to mathematics.
  - \* estimations and expectations of migrant student motivation, achievement, attentiveness, attendance
  - \* knowledge of students' earlier mathematics schooling and the use of the same or different methodologies and terminologies in their work; different responses based on such factors as different cultures, nationalities or attitudes to gender.
  - \* experiences of problems or advantages related to the mixture of students of different origins in the mathematics classroom
  - knowledge of whether migrant students tend to continue the study of mathematics beyond required compulsory levels?
  -
- Teachers will be invited to add further comment related to sections A – E or on any related topic if they wish to.**

## Consent Form

### **Fifty Years of Teaching Mathematics in Ethnically Diverse Classrooms.**

*I agree to take part in the above Monash University research project. I have had the project explained to me, and I have read and understood the Explanatory Statement, which I retain for my records.*

*I understand that any information I provide is confidential, and that no information that could lead to the identification of any individual will be disclosed in any reports of the project, or to any other party.*

*I also understand that my participation is voluntary, that I could choose not to participate, and that I can withdraw my participation at any stage of the project.*

Name .....(please print)

Signature:



AUSTRALIA

FACULTY OF EDUCATION

### Explanatory Statement

#### Fifty Years of Teaching Mathematics in Ethnically Diverse Classrooms.

*My name is Sue Wotley. I am a PhD student at Monash University (Clayton) in the Faculty of Education. My supervisor is Professor Alan Bishop. My study concerns the response of mathematics educators both at government policy levels and at individual school levels to the presence of significant numbers of migrant students in their classrooms over the last fifty years. My interest in this area has been stimulated by research which has shown that cultural factors play a vital role in the learning of mathematics. As part of my own research I wish to explore the experiences of teachers of school mathematics during this period: primary or secondary, currently teaching or retired.*

*Dear Respondent,*

*My questionnaire, included in the M.A.V. publication "Common Denominator", and which has been circulated to all members of the M.A.V., has attracted a number of responses. Thank you for your participation. You have indicated that you are willing to participate further in a follow up interview. This interview will take approximately 30 minutes of your time and may be conducted at a location convenient to you or by telephone.*

*No findings of this interview will be published which could identify any individual participant. Anonymity is assured by our procedure, in which your name or the name of your organisation will not be recorded with your responses. Access to data is restricted to my supervisor and to me. Participation in this interview is entirely voluntary. If you wish to withdraw your consent at any time this can be done verbally directly to me at the interview or by telephone. If you would like to be informed of the aggregated research findings please contact me at the Faculty of Education, Monash University (Clayton) as follows:  
Telephone (03) 9905 2868 or Fax (03) 9905 3668*

Thanking you

(Sue Wotley)

*Should you have any complaint concerning the conduct of this research please contact*

The Secretary

The Standing Committee on Ethics in Research on Humans

Monash University

Wellington Road

Clayton Victoria 3168

Telephone (03) 9905 2052 Fax (03) 9905 1420

## Appendix C

An example of responses to personal interview  
questions in Sections A and B  
from teacher T12.

**Susan Wotley – PhD (10063021). Monash Education/Clayton**  
**Personal (oral) Interviews - Collation of Results.**

School	Sect or	Loc	1 <sup>st</sup> lang	2 <sup>nd</sup> lang	Time	Ethnic minority percentage	Origins
S years 7-12	G	M	E	Swedish French Italian Some Mandarin	1960- 1990+	51-70	Albanian, Cambodian, Chinese, Croatian, Ethiopian Fijian, Greek, Indian, Indonesian, Italian Lebanese Macedonian, Slovenian Sri lankan, Turkish Vietnamese, Yugoslavian

No	Comment
T12	<p><b>Section A: Perceptions of Government Responses</b> <span style="float: right;"><b>A</b></span></p> <p><i>Aa What changes in government policy, with regard to the teaching and learning of mathematics over the last fifty years, have impacted on you in the classroom eg the change in teacher directed classrooms in the beginning of the 1970's to open classrooms which emphasised more individualistic teaching and learning later in that decade or the changing nature of VCE mathematics fields of study and assessments over this period?</i></p> <p>1992 - funding cuts - no money for welfare, careers, librarians; no strong ESL support. Government policy has created a shortage of maths teachers in the future. School based CATs introduced into the VCE have improved migrant chances of achievement because they can get help from school and home. CSF is restricting. In a recent article Jan Thomas wrote about highly focussed assessment making it more difficult for migrants.</p> <p><i>Ab Have these changes (Aa changes in government policy affected you personally in the teaching of mathematics to migrant students?</i></p> <p>I am trained in Maths and English and can focus on the language of maths. Maths teacher training is too narrow. I worked closely with the ESL teacher and now this has been lost through funding cuts.</p> <p><i>Ac Are you aware of implementation of government policies, particularly in the area of mathematics, which have been directly or indirectly addressed to the factor of migrants in the classroom e.g. training for teachers, recommendations related to text books and course materials, extra funding for schools with high migrant student numbers?</i></p> <p>No.</p> <p><i>Ad has the emergence of different government-initiated course materials such as Frameworks, National Guidelines, VCE Courses of Mathematics Study caused you to change your approach to the teaching of mathematics to migrant students?</i></p> <p>No. Language is still a big hurdle and the language focus in maths remains the same. There has been some improvement in the wording of VCE school-based requirements.</p>

**Susan Wetley -- PhD (10063021). Monash Education/Clayton**  
**Personal (oral) Interviews - Collation of Results.**

School	Sect or	Loc	1 <sup>st</sup> lang	2 <sup>nd</sup> lang	Time	Ethnic minority percentage	Origins
S years 7-12	G	M	E	Swedish French Italian Some Mandarin	1960- 1990+	51-70	Albanian, Cambodian, Chinese, Croatian, Ethiopian Fijian, Greek, Indian, Indonesian, Italian Lebanese Macedonian Slovenian Sri lankan, Turkish Vietnamese, Yugoslavian

No	Comment
T12	<p><b><u>Section B: Perceptions of Government Responses</u></b></p> <p><i>Ba Are you aware of any policies or strategies put in place with respect to migrant education in the particular school system in which you work e.g. is the catchment area for students at your school designed to attract particular migrant groups?</i></p> <p><i>Bb Does staffing of the schools reflect origins of students at the school?</i></p> <p><i>Bc Does your system contribute resources , as a result of general policy, to the teaching of mathematics to migrant students?</i></p> <p><i>Bd Are there any sort of mathematics scholarships or incentive schemes offered or recommended by your system to assist migrant students to extend their schooling? Does your system contribute resources , as a result of general policy, to the teaching of mathematics to migrant students?</i></p>
T12	<p>(12Ba) No</p> <p>(12Bb) State-wide policy p-12 has affected what we offer in language classes - French and German are not taught but we teach Italian, Greek and Chinese. Mandarin teacher and an Arabic aide are employed</p> <p>(12Bc) Migrants sometimes cannot attend maths trips either for socio-economic reasons or for cultural reasons - "permission" can be difficult to get - school offers assistance and guidance in these instances. EMA (Education Maintenance) is very important to migrant students and they tend to use it. Commonwealth funded Professional Development amounting to \$240 per staff member is available and 60% of staff would use this - the school encourages it.</p> <p>(12bd) No.</p>

## Appendix D

An example of responses from 17 teachers  
to personal interview question Ec in Section E.

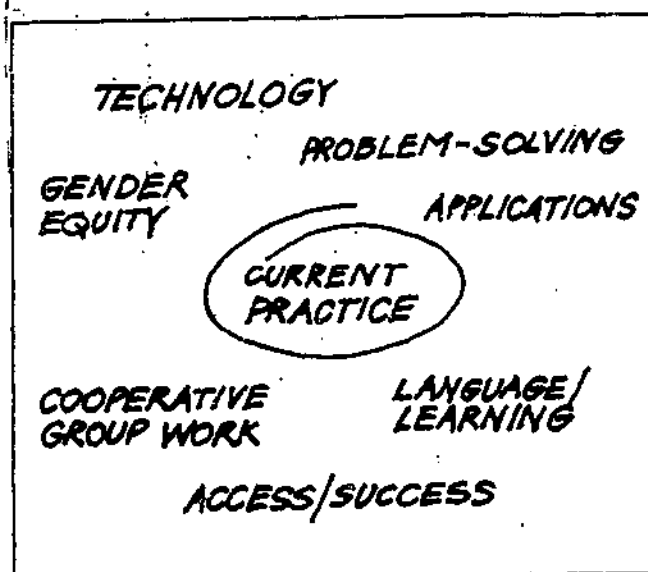
### Section E: Student Responses Ec

*Ec - What is your perception of attitude and achievement of migrant students in your classes?*

No	Comments
1	Migrant students are more motivated generally but intellectual scale is similar to that of Australians. However they are more inclined to stay in mathematics and a higher proportion of their number do 2 maths at VCE level
2	I cannot generalise. Students achieve on an individual basis. There were very strong cultural pressures on Asian students not present in Greek, Middle Eastern students. Because the school was in a low socio-economic neighbourhood some students left at age 15.
5	Most young migrant boys were out to make money -they looked to marriage, house, children - they had no confidence in school and believed that the system was against them.
6	Most students worked to parental expectations - I could not separate out migrant students on an attitude basis. As it happened highest achievers were Anglo-Celts but I really could not separate achievements out.
7	Migrant students were generally ambitious and there was some application of pressure by parents. Generally they were highly motivated and were capable of perseverance and persistence. There was evidence of a network of help from older siblings and university friends in some cases. In school B at VCE level the Chinese and Japanese students achieved a higher mean mark than the rest of the students whose origins were mostly Anglo-Celt. - they did not necessarily achieve the highest marks but as a group their average performance was better eg they rarely achieved maths scores below C level.
11	Migrant students are generally highly motivated and "hungry" for knowledge - to "get on" they need to be good - it takes 2 generations "sink" to Australian levels of motivation. I think their attitude comes possibly from sharing ideas with family around the table. They do not have money for students to work in their own rooms.
12	Chinese students have their own parental pressures to succeed. Our school runs after school "Discovery" classes in English, Maths and Science using a program imported from Israel. Attendance at these classes is voluntary but costs extra money - students pay \$25 per term -they are held for years 7 to 9 for 2 hours per week from 3 to 3.30 pm - the course is structured and run by teachers at the school who are paid \$23 per hour. This is extra teaching over and above the normal school allotment of teaching. We have tried to establish a team of teachers in this scheme - the units are 10 weeks long and about 8 to 10 teachers work on them each term. There are a lot of students of migrant origin attending these classes. Vietnamese students show different levels of achievement and motivation in different waves of migrations and generations. I believe that the migrant mixture enhances the performance of the class.
17	There is an expectation that Asian students will be good and that their parents will push their children to succeed. Europeans students are expected to be lazy but smart.
19	At present, Asian students are highly motivated, both females and males, and have role models such as engineers. I think this is because Asian society is highly technological.
21	Asian students were very highly motivated and on the whole achieved at a higher level. Asian students tended to stay in their own social groups as did others eg Jewish students.
24	Asians are more ambitious and they are the hardest working students. They ask for extension sheets and seem to "hunger and thirst" for work. This attitude is not present in the Australian students. In general Asian students achieve at a higher level than Australian students.
26	Migrant student progress seems to be closely linked to parental interest and also expectations of peers of the same nationality give them confidence. Lack of language skills creates problems. Cultural and religious relations can also interfere with class work eg Somalian and Eritrean tribally-based animosity between students has necessitated counselling and information sessions. In all the nationalities, I think (primary) education is geared to girls but

	Muslim girls can be disadvantaged depending on which Islamic country they come from and also by their chronological position in the family. The first girl children are the ground-breakers for younger sisters and there are restrictions placed on them by parents in areas of sport and music - they can have heavy family responsibilities as carers which interrupt their work. Their previous education can be very poor and the degree of Westernisation in their previous country is important to their progress. However most are encouraged. The most recent arrivals require 1 to 1 attention. I find that migrant students often work harder than others.
27	I find that the achievement patterns have changed over the years - in the 1960's there were many high-achieving Italian students: In the 1970's and 1980's expectations in the Italian students and parental support for them were still high. In the 1990's there is less push from the parents and the achievements of students of Italian origin are more evenly distributed.
29	Attitudes and achievements are totally mixed. I think South East Asian students spent more time on their work but this does not necessarily lead to higher success. Duxes tend to be Italian and Lebanese and these students are "stolen" by more prestigious schools. For some migrants the notion of applying for scholarships is not familiar eg Vietnamese students do not like to be alone in a school community but prefer to be with their own nationality. Chinese students are particularly education-oriented and tend to have business oriented parents - they do apply for scholarships - to them the name of the institution and the social kudos is more important than the academic program.
30	South American students do not seem to have much "natural talent" in maths. Chinese students achieve best - their talents and attitudes make them very successful. Vietnamese students are in 2 groups - the first wave were very highly motivated but the second wave contains elements of apathy - I adapt some Chinese methods - there are some very good Italian students.

## Appendix E



The Mathematics Framework P - 10  
 Ministry of Education (Schools Division), Victoria  
 1988, 15

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