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THE NEGOTIATION OF

PERCEIVED VALUE DIFFERENCES

BY IMMIGRANT TEACHERS OF MATHEMATICS

IN AUSTRALIA

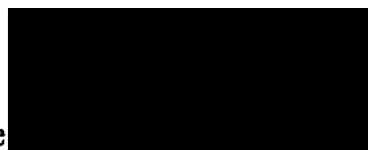**Wee Tiong Seah, MEd (Monash), PGDE Sec(Singapore), BSc (Singapore)**

A thesis submitted in total fulfillment of the requirements for the degree of

Doctor of Philosophy, Faculty of Education, Monash University, Victoria, Australia.

Nov 2004

DECLARATION

I, Wee Tiong Seah, hereby declare that this thesis contains no material which has been accepted for the award of any degree or diploma of any university, and to the best of my knowledge and belief, the thesis contains no material previously published or written by another person, except where due reference is made in the text of the thesis.

Signature of candidate

Date: 30 NOV 2004

This research project was granted approval by the Standing Committee on Ethics in Research Involving Humans of Monash University on 20 April 2000 (Project 2000/123).

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This research study has been appropriately nicknamed 'The Expedition', for the past few years of working on this study has brought me on an exciting and ongoing journey of discovery and learning, both in terms of inquiring into the research questions and (more importantly) learning the ropes of conducting academic research. It has been an exhilarating trip where roadside features and scenery have been sources of stimulation, knowledge and skills, and an exciting one where suspense could await round the next corners and bends.

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Involvement in this expedition reflects my valuing of education — both in terms of educating and being educated. I am always indebted and thankful to my parents, **Seah Bock Kim** and **Choo Ai Keow**, for fostering this value in me since my childhood days, and for the many sacrifices they have made to guide me (and my siblings) through premium education. My thirst for knowledge, and my continual quest for 'expeditions', are borne out of the high hopes my parents harbour for me.

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ABSTRACT

As mathematics and school mathematics are often misconceived as culture- and value-free, the classroom teaching of mathematics can be erroneously considered as easily transferable between cultural sites. In the context of an increasingly multi-cultural teaching profession in Victoria, Australia, this study examines the professional socialisation experiences of immigrant teachers of secondary mathematics. Adopting a socio-cultural perspective, the study aims to explore the nature of perceived value differences relating to mathematics, pedagogy and education; how these differences are negotiated; and the contextual factors through which such negotiations take place.

The research design is mainly qualitative in nature. The study was structured through a state-wide survey of 159 secondary schools and a questionnaire survey of 35 immigrant teachers of secondary mathematics from these schools. Case studies were then conducted with 8 of the immigrant teachers, involving discussions, lesson observations, interviews, and content analyses (of teacher marking). Each of the inhabited continents has been represented by at least one of these eight teachers.

A total of 34 perceived value differences were reported by the 8 teachers, whose teaching experience in Victoria ranged from 1 to 27 years. The value differences were found to be mathematical, mathematics educational, general educational, and organisational in nature. Opportunities for the perception of value differences were not found to be related to length of service in Victoria, and neither was it related to 'cultural distance'.

Other than possibly responding with a sense of helplessness, the ways in which value differences were negotiated can be classified into six responsive approaches. These reflect different teacher assumptions and dispositions, including a need to espouse the home culture, a desire to portray the host culture, and a disposition to embody the essence of both the home and Australian values. That each teacher had responded to similar perceived value differences with different approaches demonstrates how sense-making of difference is contextualised within socio-cultural factors at the individual, interactional, institutional, and societal levels. Thus, beyond the celebration of teacher diversity, the

findings demonstrate the complexities with which reality is co-constructed by both the immigrant teacher and her socio-cultural environment.

Theoretically, the conceptualisation of personal value schema in this study helps to explain how values underpinning contextual factors interact to guide choice of responsive approaches. The study shows how 'competing', 'overriding' and 'second-hand' values can thus be regarded as part of a teacher's schema rather than as isolated, independent values. In this light, the negotiation of perceived value differences represents the re-establishment of harmony and equilibrium amongst the constituent values of teachers' personal value schemas.

The valuing of *numeracy* and *technology* stood out strikingly from the data as being features of the Victorian mathematics curriculum. The potential for this to inform the ongoing Victorian curriculum reform is discussed. Implications for more effective induction and in-service professional development programs for immigrant mathematics teachers, for other teachers in transition, and for educational leaders, are also identified. Other implications for practice and suggestions for further research are also made, highlighting the potential of this thesis to contribute to both theory and practice.

'VALUES IN MATHEMATICS EDUCATION' DEFINED

The following definition for 'values in mathematics education' will be developed (in chap. 2) and used in this thesis:

> Values represent an individual's internalisation, 'cognitisation' and decontextualisation of affective constructs (such as beliefs and attitudes) in her socio-cultural context. Values related to mathematics education are inculcated through the nature of mathematics and through the individual's experience in the socio-cultural environment and in the mathematics classroom. These values form part of the individual's ongoing developing personal value system, which equips her with cognitive and affective lenses to shape and modify her way of perceiving and interpreting the world, and to guide her choice of course of action. They also influence the development of other affective constructs related to mathematics education and to life.

CHAPTER 1

INTRODUCTION TO THE STUDY

to 'culture switch', to know what behaviour is appropriate in different social situations, in different environments, is probably much more difficult than to 'code switch'. 'Culture switching' by its very nature implies making decisions about values, about feelings, about people, about in-groups (us) and out-groups (them). (Eckermann, 1994, p. 226)

The study on which this thesis is based relates to the professional socialisation of immigrant teachers of mathematics in secondary schools in Victoria, Australia. The term 'immigrant teacher' will be used in this study to refer to practising teachers in Victoria who were born, educated, and accredited to teach, in a country outside Australia. Although the number of such teachers of mathematics is relatively small when compared to the other teachers of mathematics in the state, this chapter will argue why the extent to which these immigrant teachers socialise successfully into the local teaching service cannot be ignored. This chapter will also provide the background against which the research problem is identified.

1.1 Multiculturalism in Victoria, Australia

The state of Victoria in Australia, occupying an area of 227 416 km^2 as in 2002 (Australian Bureau of Statistics, 2003), ranks sixth in geographic size among the eight

Figure 1.1. State of Victoria, Australia.

states/territories of the Commonweath. This accounts for nearly 3% of Australia's total land area (Australian Bureau of Statistics, 1999b). However, it is the second most populous state/territory in the country, making it the most densely populated Australian state (at 20.2 persons per km^2) (Australian Bureau of Statistics, 1999b).

Australia has historically been a country of settlers and immigrants. By the 1990s, nearly a quarter of Australians were born in about 100 countries overseas (Victoria Immigration Museum, 2003). Look at in another way, only 2.4% of residents in Australia were identified as people of indigenous origin in the last census (in 2001) (Australian Bureau of Statistics, 2003). Furthermore, amongst th states and territories of Australia, Victoria has the least proportion of indigenous population (Australian Bureau of Statistics, 2003). Indeed, Victoria is multi-ethnic and multi-cultural in its demographic makeup. Currently, this phenomenon is both socio-political (as in migration from troubled lands) and economic (as in short- and long-term human movements in the current globalization of trade and services) in origin. Victorian population's evolving diversity has reflected the successive migration waves of the British in the early years of colonisation and in the post World War II days, the Italians and Greeks in the 1970s, the Vietnamese followed by the Malaysians in the 1980s, and the people of Hong Kong and Taiwan in the 1990s. While arrivals from Britain and New Zealand have traditionally been the major source of immigrants, this has been taken over in the recent years by the Chinese from mainland China. As at the end of June, 1996, 25.1% of Victoria's 4.6 million residents were born in more than 39 different countries outside of Australia (Australian Bureau of Statistics, 1999a, p. 88, Table 42).

This introduction to Victoria, Australia is significant for this study. Victoria is the site in which the study will be conducted. That the state has been selected to be the research site is partly due to practical concerns such as convenience and familiarity of relevant contacts. More importantly, however, is the depth of Victoria's multiculturalism which is important for a study like this which examines professional socialisation in a cross-cultural context.

1.2 Immigrants in the Victorian Teaching Service

The multicultural, multiethnic fabric of life in Victoria is reflected in educational institutions as well. Not only are there increasing numbers of immigrant and ethnic minority (i.e. non-Anglo-Saxon) students in the Victorian school classroom, there is also

an increase in employment of immigrant teachers in Victorian state, Catholic and independent schools in recent years. The latter has partly been a response to Victorian governmental policies in the 1990s promoting the teaching of Languages Other Than English (LOTE), which have resulted in a demand for teachers who are able to speak and teach Asian languages (Santoro, Reid, & Kamler, 2001). However, there are other likely reasons for this demand for immigrant teachers as well. After all, many of these teachers did not come from countries of which the various LOTE languages are the vernacular, such as China and Indonesia. The immigration system has also been favourable in recent years towards applicants who are trained teachers. Specifically, immigrant trained teachers help to fill the predicted shortfall of nearly 2 000 teachers which Victoria will experience by 2005 (Jones, 2000). Like many other countries in the world, Australia is experiencing a shortage of teachers to meet the staffing needs of her schools, estimated at a shortfall of up to 20 000 to 30 000 teachers in the years leading up to 2010 (Auditor General Victoria, 2001; Australian Education Union, 2001; Australian Ministerial Council on Education, Employment, Training and Youth Affairs, 2003). In Victoria, this situation is due partly to the state's teacher redundancy exercise in the 1990s, which saw the departure of some 8 000 teachers. Many of these teachers who left the teaching service were then relatively young. This has the effect of raising the average age of a teacher practising in the state.

This problem of the greying of the teaching workforce applies to the subject of school mathematics as well. Specifically, a survey of 518 state secondary schools in Victoria conducted by the Australian Education Union in 2000 revealed a serious shortage of teachers of mathematics (Farouque, 2001; also see Ketchell, 2001). Dunn (2002) reported that the state's shortage of teachers of mathematics extends across all school systems in both metropolitan Melbourne and country Victoria. Unfortunately, the real shortage may be partly hidden in official statistics and reports, since secondary school principals have the autonomy of deploying other subject teachers to take over mathematics lessons. For example, at the national level, about 12% of secondary teachers were teaching mathematics as their first or second main subject, even though it is not the subject for which they had the highest qualification (Australian Ministerial Council on Education, Employment, Training and Youth Affairs, 2003). The common misconception may be that since all teachers possess school mathematics qualifications at the pre-tertiary level,

they would have the necessary content knowledge to teach this supposedly culture-free subject!

Applicants to teacher training institutions then also had to contend with feelings of job insecurity when teaching contracts may last for as little as one year. As a result, teaching was relatively unattractive as a career among school leavers; only 5.4% of university undergraduate entrants applied for education courses in 2000 in Victoria (Fannin, 2000). The last few years, interestingly, have seen an increase in applications for pre-service teacher education courses. This may have come about as a result of a softening in some sectors of the economy (for example, the information technology industries), and government exclusion of teacher education courses from tertiary fee hikes. However, limited federal government funding and capping of teacher education places in tertiary institutions have been a significant stumbling block towards resolving the teacher shortage situation. The state's continual failure to meet the demand for teachers has meant that engaging immigrants who are professionally qualified can help alleviate the situation somewhat, and do so in a relatively short period of time.

These immigrant teachers are allowed to practise in local schools once they demonstrate to the Victorian Institute of Teaching (VIT) the required residency status and the qualification of equivalent teacher education courses overseas. (Teachers from New Zealand, however, are automatically registered for practice in schools, under the Trans Tasman Mutual Recognition Act 1997.) There is no formal initiation program in place for these teachers, many of them new-arrivals to Australia. Once registered by the VIT, they effectively compete with other applicants for advertised teaching positions. If successful at one such school interview, professional practice in Australia for these immigrant teachers begins almost immediately.

1.3 Roles of Immigrant Teachers

The positive role and professional contribution of these immigrant teachers (and for some, ethnic minority teachers as well) in the increasingly multicultural school classroom has been well-documented in educational research. Research conducted in America (Asam & Cooper, 2000; Bascia, 1996; Chinn & Wong, 1992; Su, Goldstein, Suzuki, & Kim, 1997) generally emphasises the modeling role of ethnic minority teachers in an increasingly diverse school student population. Bascia (1996) sums this up in her opening

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paragraph:

schools are trying to meet the needs of a student population which is increasingly diverse in cultural and racial terms and whose intellectual, social, emotional, and physical needs represent formidable challenges for many educators. Scholars and policy makers, in response, have recommended ... an increase in the number and proportion of racial and ethnocultural minority teachers in the workforce, including new immigrants .... [This] assumes that there is a positive relationship between the teacher's race, culture, or life experiences and the quality of their interactions with students, though this relationship is not well specified or understood. (p. 151)

In particular,

American teacher education scholars and reformers have argued passionately for the necessity of pursuing both a culturally informed and culturally diverse teaching population. They maintain that teachers from ethnic minority backgrounds will engage in culturally relevant pedagogy, and that teachers of color will be more likely than their white counterparts to embrace approaches to multicultural education that seek to enhance the social status of ethnic minority groups. (Su, 1996, p. 117)

This role modelling function extends beyond cognitive pedagogical concerns. The native Hawaiian teachers in Asam and Cooper's (2000) study shared the view that education is a vehicle for social change and they also shared a general "sense of responsibility [among these teachers] to share their knowledge of culture, language, and values" (p. 22). Thus, seeing themselves as role models, they felt empowered to help native Hawaiian students achieve more at school, to guide them in striking a balance between Hawaiian values and western values, and to mediate any discrimination experienced by these students.

Chinn and Wong (1992) demonstrated in their study how Asian and Pacific American teachers in the United States not only acted as role models for students, but were also language and academic support providers for immigrant students with limited English proficiency, as well as mediators for their non-Asian and Pacific American colleagues. Bascia's (1996) research with six teachers in Canada also suggested this mediatory role of immigrant teachers, as a result of these teachers' differing cultural conceptions of teaching, and empathy arising from common experience.

1.4 The Hidden Problem

Just as living in a different culture often requires a period of orientation and adjustment, transition in the education context can have a significant impact on the quality of the learning and teaching experiences of individuals involved. Research such as those conducted by Dockett and Perry (2002), and Perry and Howard (2002), demonstrated the importance of facilitating the transition of students from home to

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school, and from primary to secondary school respectively. So too will teaching in a classroom in a different culture be associated with difficulties and differences. It is perhaps not too difficult to imagine how this need for professional adjustment comes about when students and parents in the different culture may interact with the teacher differently, when schools function differently, and when a different curriculum or syllabus is in operation. Furthermore, immigrant teachers can sometimes appear invisible to their colleagues, especially when they are Anglo-Saxon. In fact, it would be rather reasonable to suggest that immigrant teachers from culturally-similar countries like Britain, New Zealand and Canada may not even be expected to require any adjustment and assistance with socialisation. After all, these nations and Australia share a common Western democratic culture, the same head of state, and similar Western educational frameworks. Furthermore, school mathematics is often perceived to be culture-free knowledge. In other words, difficulties and complexities associated with attempts by immigrant teachers to socialise into the profession in Victoria may not be recognised. In turn, immigrant teachers may not be offered opportunities or support to adjust to the different workplace culture, and there may also be unrealistic expectations that they will be able to practise in the 'Australian way' almost immediately. Unfortunate instances of immigrant teachers leaving the education service way before their respective retirement would only serve to negate efforts to address current and projected staffing problems, and deprive us of opportunities to tap into the intellectual and cultural funds of these immigrant professionals. The hidden problem is potentially masked further by the imagery of 'successful' immigrant teachers remaining in the profession. Thus, the initial motivating factor for this current research study was borne out by concerns relating to the professional socialisation experience of immigrant teachers of mathematics in the Victoria classroom, especially if these teachers had assumed that mathematics is a school subject that can easily be taught overseas because it is supposed to be a culture-free discipline.

1.5 Conceptualising the Problem from a Values Perspective

The nature of the problem potentially experienced by immigrant teachers may be understood by adopting the values perspective. As will be elaborated in Chapter 2, the cultural differences encountered by the immigrant teachers may be related to differences in which different cultures emphasise certain values over other values. An understanding

of immigrant teachers' feeling of dissonance can then be achieved through examining the nature of cultural value differences perceived by them in the mathematics classroom.

After all, what better place than the school classroom to examine values in action and interacting with one another? Education is a form of cultural transmission (Singleton, 1974), and what each culture deems as desirable or important is often manifested in its own educational framework (Kohlberg, 1981; Neuman, 1997). "For sociologists and most educationalists, education, the process of continued socialization, is aimed at specific socio-politico-economic goals far beyond acquisition of the 'Three Rs'" (Eckermann, 1994, p. 39). Thus, the very act of teaching someone something is necessarily value-laden, and involves influencing the development of the student's value system, although this involvement may not (always) be explicit to the teacher (Gudmundsdottir, 1990).

It may be argued that the teacher's role is extremely integral to the extent to which schools successfully portray 'desired' values and inculcate these in the students. In fact,

> teachers cannot withdraw from showing the values that are important to them. In the cultural policy of the government and the school, teachers are even supposed to stimulate the development of specific values. But modern society expects also more and more that young people make choices of their own accord and that they assume responsibility for these choices, also with regard to values. (Veugelers & Kat, 2000, p. 11)

This may be consciously carried out and planned for in the form of values transfer, values-forming education (Veugelers & Kat, 2000), or values clarification exercises. Values are also portrayed and emphasised less explicitly through teacher behaviour and teacher-student interactions, and judging by the 'balance of power' that often exists between teachers and their students, the impact of such hidden or implicit values portrayal can be significant.

In this regard, immigrant teachers bring with them to Australia their cultural 'funds of knowledge' (Moll, 1994) pertaining to content and pedagogy. These are associated with their respective cultural baggage of attitudes, beliefs and values. These may be different from the corresponding dominant attitudes, beliefs and values in Australia, even if the teachers involved had arrived from culturally-similar sources of migration in Australia, such as Britain and New Zealand. In particular, these immigrant teachers (like all other teachers) subscribe to certain attitudes, beliefs and values with regards to school mathematics as a discipline and to the ways in which it is best taught and learnt, in ways which reflect their respective home cultures' corresponding attitudes, beliefs and values. There is thus often a need for these teachers to consider and to make decisions about how

these different feelings and values should play out, to 'culture switch' as highlighted in the opening quote of this chapter. Therefore, value differences and conflicts in the Australian classroom are inevitable.

But what is the notion of the Australian culture and of Australian values in the context of a multicultural and multiethnic society such as in Victoria? Furthermore, any observation of what appears Australian from a culture's viewpoint can be a relative concept when other cultures' viewpoints are taken into account. In this sense, then, the Australian culture will be taken in this study to refer to that which is conceptualised by the individual immigrant teachers. For each of them, this vision of what constitutes the Australian culture is most relevant to her as she attempts to make sense of perceived value differences and to negotiate such differences.

Differences in values across cultures also exist at the state/national level. For example, a sense of what the Australian and Victorian mathematics curricula value may be discerned from the corresponding curriculum frameworks. The goals for school mathematics in Australia are encapsulated in 'A national statement on mathematics for Australian schools' (Australian Education Council & Curriculum Corporation, 1991). Affective objectives towards the teaching and learning of— and function of— mathematics are evident, at times implicitly. "Students should develop positive attitudes towards their involvement in mathematics" (p. 12). Teaching and learning are to be structured such that students "experience the processes through which mathematics develops .... [so as to be aware that] mathematics is not always systematic and formal .... [and that mathematics] has its roots in many cultures" (pp. 14-15).

In stating that "students should develop confidence and competence in dealing with commonly occurring situations" (p. 11), both affective (*confidence*) and cognitive/psychomotor (*competence*) educational outcomes are articulated. There is also an expressed goal for students to learn "techniques and tools which reflect modern mathematics" (p. 13), which includes the idea of random models of the world as against a worldview consisting of events as inevitable consequences that can be described by rules and formulae, as well as the use of discrete methods (such as networks) against representing phenomena as continuous (such as in calculus). There is thus an acknowledgement of the nature of mathematics as dynamic and developing.

At the state level, the mathematics curriculum statement document in Victoria, called the mathematics 'Curriculum and Standards Framework' (CSF), lists seven goals for mathematics learning in schools (Board of Studies, 2000, p. 6). Each of these goals reveals one or more mathematical and/or mathematics educational values. For example, the reference to mathematical ideas as logical conveys the mathematical value of *rationalism*. Pupils are to "understand and appreciate … the processes by which mathematics changes and its cultural role" (Board of Studies, 2000, p. 6), which portrays the message that mathematics is a dynamic, multi-cultural discipline.

Four of the goals also refer to the mathematics educational value of the *applicability* of mathematics to — and *relevance* in — daily life: "mathematical skills and knowledge … [allow pupils to] deal confidently and competently with daily life …. [, are useful] for employment, further study and interest …. [, are of] fundamental importance …to the functioning of society …. [, and play a] dynamic role   in social and technological change" (Board of Studies, 2000, p. 6). The goal relating to technology use also reflects the mathematics educational value of harnessing *technology* to support mathematics learning and mathematical activities. While the corresponding curriculum frameworks of the cultures from which immigrant teachers came — and in which they practised — may espouse some of these values, it cannot be assumed that all these values are encapsulated in the teachers' respective home cultures.

For immigrant teachers, the findings of this study are expected to represent in some ways their voices regarding their respective experiences in socialising into the teaching of mathematics in Australia. Personally for them – and especially for the teacher participants in this study – the stories that will be told are expected to lead to a better understanding of the extent to which their personal value systems impact on their teaching of mathematics in Australia. This knowledge is expected to empower them to respond to future perceived value differences more constructively than the differences might otherwise be negotiated. The stories constructed in this study may also contribute towards a form of (professional) support for immigrant teachers, one which reminds each of them that she is not alone in having to deal with value differences, and that she is not professionally isolated by the wider educational (research) community while she attempts to socialise professionally in Australia. The implications for teacher self-efficacy and teacher effectiveness are evident.

1.6 Wider Significance of Study: Beyond the Immigrant Teachers

Clearly, the findings of this study may also be of relevance to our understanding of the professional lives of all teachers, as they experience transition and the associated value differences in more general ways at various points in their respective careers. Culturally-based transitions take place when a teacher moves between middle and senior schools in the same campus, between schools in different suburbs, between city and country schools, between government and non-government schools, between co-educational and single-sex schools, or when the teacher finds herself in the midst of policy or workplace changes. There is clearly a need to foster an inclination — and build up the capacity — for teachers to function in a workplace where change is the only constant. Indeed, one of the recommendations of a recent Australian government review report called for

> research [to] be undertaken on the working lives of teachers, their professional aspirations and ways in which changed conditions of schooling and employment might enhance the attractiveness of careers in teaching. (Australian Government Department of Education, Science and Training, 2003a, p. 17)

The theoretical and practical significance of this study are not only restricted to the level of the individual teachers. At the institutional/systemic level, the nature of the immigrant teachers' experiences with cultural value differences not only have implications towards their respective socialisation process and professional well-being, but also towards the quality of mathematics teaching and learning which take place in these teachers' classrooms in Australia. "Value conflicts almost certainly lead to painful dissonance that negatively affects one's ability to assimilate new experiences" (Court, 1999, p. 43). Dossey (1992) quoted research which showed that the different conceptions of (and thus values placed on) mathematics "have an influence on the ways in which both teachers and mathematicians approach the teaching and development of mathematics" (p. 39). What teachers and students value in the content and the pedagogy of school mathematics

> seem to have a deep influence on how, why and what we learn. Hence, depending on the values learnt in mathematics classrooms, students may be helped in their life long learning, or may sadly learn values that inhibit their in-built creative potential. (Clarkson, Bishop, FitzSimons, & Seah, 2001, p. 44)

For an immigrant teacher who is unable to reconcile dissonance related to content and pedagogy, concerns about the nature of school mathematics that is being subsequently taught may arise. Would the teacher regain psychological comfort by reverting to

teaching mathematics the way she did in her home country? How appropriate would this school mathematics be for the Australian society? Would the portrayal of mathematics as *mysterious* be in line with the visions of the local mathematics curriculum framework? How about a mathematics teaching style that values *transmission* over, for example, *investigation*?

Furthermore, there can also be questions of how the portrayal of values may afford or constrain students' learning process. For example, a teacher might have been educated and/or trained in a mathematics educational system which values *drills* and *practice*, where pedagogical activities may be designed to optimise instrumental understanding. Homework or self-practice is thus very much encouraged. It is not a matter of whether this mathematics teaching approach leads to greater student understanding; it may well be the most appropriate or effective teaching style in the teacher's home cultural setting. The cultural, societal and economic demands in Victoria, however, may likely have no place for mathematics learners who are adept only at applying the right algorithms to solve mathematics questions.

Consider another scenario. A mathematics teacher subscribing to one form of the Islamic view of knowledge acquisition is likely to emphasise student learning through attainment of *peace of mind* and *freedom* from any distraction of the senses (see Moosavi-Movahedi, 1999). This teacher's teaching practice is thus not likely to incorporate any peer discussion and group investigative project. Again, in the Victorian context, there are implications of such teaching styles in relation to the optimisation of the mathematics learning experience of local students.

There are also implications for the sustained presence of ethnic minority teachers in an educational system which provides for a multicultural society such as in Australia. Su et al. (1997), for example, identified the "lack of role models – minority faculty and staff in K-12 schools and higher education, including their professional education – as a significant deterrent" (p. 289) for Asian Americans to enter teaching. The maintenance of a visual mosaic of a multicultural and multiethnic teaching profession can relay convincing and positive messages to the younger generations of all ethnic groups about the worthwhile contributions different cultures make to the education enterprise. This point was emphasised in a recent Australian government review committee report relating

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to Australia's teacher future:

Australia is one of the most ethnically and culturally diverse countries in the world, but this diversity is only partially reflected in the composition of the teaching force. Since schooling to the age of 15 or 16 is universal and a high proportion of students complete a full secondary education, it is reasonable to expect that teachers have the full range of backgrounds needed to relate to a diverse student population .... There is great value in recruiting to the teaching profession more people from the diverse ethnic and cultural backgrounds of the Australian population. (Australian Government Department of Education, Science and Training, 2003b, p. 74)

More generally, too, the kinds of values teachers espouse have a direct consequence on the pupils' development of personal character, outlook and world-view. Bishop (2001) reminded teachers that "whatever decisions you make depend on your values, and through the choices you make, you are implicitly shaping the values of your students" (p. 346).

From the societal perspective, not all values may be relevant, suitable or desirable in different societies. For example, in the Confucian-heritage culture of the Republic of China (Taiwan) where the mathematics curriculum is very much influenced by American educational ideas such as constructivism, questions are being asked about the possible consequences of unquestioned acceptance of values underpinning these foreign ethoi (Chin & Lin, 1999a).

The significance of this study extends beyond immigrant teachers in yet another way. Through the stories told by the immigrant teachers, it is expected that the distinctive features of the school mathematics curriculum in Victoria may be identified. These may not be reflected in recent educational initiatives, and as such they may be salient characteristics of the curriculum which distinguish it from mathematics curricula elsewhere. This information is important in not only helping develop a better understanding of what the mathematics curriculum in Victoria values, but also in facilitating future diagnosis of aspects of the curriculum which may require reform. Yet, as the saying goes, 'the fish is the last to know water'; immigrant teachers practising in Victoria may be able to bring to the fore features of the local mathematics curriculum in ways which 'local' teachers and administrators are often unable to. The failure of the Czech country associate to identify an unique characteristic of a typical mathematics lesson during the Third International Mathematics and Science Study-Repeat (TIMSS-R) study, and her subsequent explanation that the norm did not appear significant to her personally to warrant mention, is an indication of the potential amount of knowledge that

local professionals may often take for granted (Hollingsworth, personal communication, September 6, 2003).

1.7 Positioning this Study within Mathematics Education Research

Mathematics educational research on immigrant students or teachers of mathematics has not been well-represented in the field, and neither is mathematics educational research focussing on ethnicity: only 0.2% and 3.7% respectively of 3,011 mathematics education research articles published in 48 national and international education research journals between 1982 and 1998 are categorised in these groups (Lubienski, 1999).

A review of literature on teacher socialisation in the 'Handbook of research on teacher education', noted that "the socialisation of minority teachers ... has been totally neglected in the literature to date" (Zeichner & Gore, 1990, p. 335). This point was highlighted again more recently (see Su et al., 1997). This has effectively contributed to a view that the teaching profession is de-racialised (Kamler, Santoro, & Reid, 1998). Much educational research related to immigration in Victoria and elsewhere has also focussed on immigrant pupils in local schools. Studies on immigrant teachers in general, and immigrant teachers of mathematics in particular, have been relatively scarce.

Furthermore, educational research investigating value conflicts experienced by immigrant teachers of mathematics has been both relatively recent and scarce. One possible reason is the apparent difficulty in relating values to mathematics teaching and learning. This is in turn partly due to a rather fuzzy understanding of, agreement to, and distinction among the various affective variables such as attitudes, beliefs and values (McLeod, 1992; see also Gribble, Rennie, Tyson, Milne, & Speering, 2000). Indeed, Krathwohl, Bloom and Masia (1964) note that common affective terms such as 'interest', 'appreciation', 'attitude', 'value' and 'adjustment' overlap one another over several categories of their taxonomy of affective educational objectives (p. 37, Figure 1).

Also, related terminologies have been used interchangeably, as in religious faith/beliefs/values, leading many to conclude wrongly that the terms are synonymous. The word 'value' itself has several different usages in the language too, such as in the 'value' of an unknown in an equation, the 'value' of listening to a speech, and the (moral) 'value' of an individual. Another contributing factor is that reliability of affective studies has generally been questionable in the academic field (Southwell, 1995).

Yet, voices are being heard within the mathematics education research community that 'affect in mathematics education' (broad as it is) has not been studied as much as it could possibly have been (Hannula, 2001; Lubienski, 1999; McLeod, 1992), and Southwell (1995) noted a renewed interest in the field. As McLeod (1992) noted in his review of mathematics education research in this area:

> affect plays a significant role in mathematics learning and instruction .... [and although it] is a central concern of students and teachers, research on affect in mathematics education continues to reside on the periphery of the field. If research on learning and instruction is to maximize its impact on students and teachers, affective issues need to occupy a more central position in the minds of researchers. (p. 575)

At the same time, it must be noted that what is generally considered as research on affect in mathematics education has mainly only focussed on gender, attitudes and beliefs (e.g. Anderson, 1998; Bleicher, Cooper, Nisbet, & Warren, 1995; Bobis & Cusworth, 1995; Callingham, Watson, Collis, & Moritz, 1995; Carroll, 1995; Galbraith & Haines, 1998; Gervasoni, 1995; Gondoseputro, 1999; Kaleva, 1998; Perry & Howard, 1999; Perry, Howard, & Tracey, 1999; Philippou & Christou, 1998; Raymond, 1997; Thompson, 1984; Wang, 1999). Amongst the handful of studies on immigrant teachers, many have focussed on these teachers' experience of racism in their respective host cultures (e.g. Peeler, 2001; Santoro, 2000).

Yet, the role of values is more explicit in some other school subjects, such as the languages (e.g. Lee, 2004; Schmidt & Pailliotet, 2001), literature studies (e.g. Estes & Vasquez-Levy, 2001; Lambarski, 2005; Lickteig & Danielson, 2005; Romano, 2002), history (e.g. Manzo, 2004), music (e.g. Teaching Pre K-8, 2002), art (e.g. Leshnoff, 2003; Silvers, 2004), physical education (e.g. Aplin & Saunders, 1996; Chen & Ennis, 1996; Lee & Cockman, 1995; Murray, 1977), and the sciences (e.g. Allchin, 1999b; Proctor, 1991; Tan, 1997). It may be that these other subjects deal with aspects of life experiences more directly and more explicitly, so that values can be easily associated and/or discussed with them. Mathematics, on the other hand, can often be seen to deal with abstract entities and ideas, and with how these are applied to real-life situations (and indeed to many of the other school subjects mentioned above!). Until recently, school mathematics has often been misunderstood as being value-neutral (e.g. Bishop, 1988; Bishop, FitzSimons, Seah, & Clarkson, 2001).

Informal observations and conversations have suggested however that the affective state of the student plays an important role in determining the extent to which the school

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mathematics learning process is successful for the student. Positive affect may well provide the environment within which cognitive goals may flourish. While student motivation may be the common goal in this endeavour, the affective qualities which different cultures identify as fostering motivation may differ. In some cultures there may be an emphasis on maintaining student interest and confidence, or on delivering a student-centred curriculum. In others, student motivation may be fostered through student valuing of *patriotism* (to school, to nation, etc), or of intrinsic benefits of acquiring mathematical reasoning skills. Perhaps, the observed shift of research attention from a macro description of mathematics education (e.g. goals, content, pedagogical methods and evaluation) to a more micro description (e.g. the breaking down of 'pedagogical methods' into units such as classroom furniture layout, teacher-student roles) has also brought out the value-laden nature of mathematics education (Jurdak, 1999). Unfortunately, the notion of value often remains implicit, or its contributing role not articulated enough. Yet, as the foregoing discussion suggests, values may well underlie students' attitudes to, and beliefs in. their learning of mathematics.

In this context, the relative lack of research interest in affect in general, and in values in mathematics education in particular, may be taken to mean that enough is already known regarding the role of values in mathematics teaching/learning. This assumption, however, will be challenged in Section 2.2.

Also, this situation may reinforce the notion that immigrant teachers of mathematics are essentially invisible, that there should be few problems teaching and facilitating the learning of the canonical, 'Western' school mathematics across cultures, much like a medical professional practising in different countries. Yet, informal observations and personal communication have revealed problems with adjustment in the Australian classroom, as well as the unfortunate and unintended re-direction of intellectual and cultural resources when some of these teachers had no choice but to leave the teaching service shortly after they had begun their practice in Victoria.

Could the popularity of cognitive research be explained in part by the relative ease with which programs or assessments may be designed and implemented, and by the similar ease with which 'improvements' may be measured? Or, could cognitive research be more prevalent because the data deals with matter of the mind rather than the heart, and thus more impersonal and/or more reliable? Is it likely, also, that 'improvements' in

cognitive development are often realised in a short period of time, thus promoting teacher accountability and/or attracting the approval of grant-releasing educational research centres?

At the same time, while cognitive research studies have allowed us to understand the mathematics learning process better and to design more appropriate curricula to facilitate this mathematics learning process, the degree to which these are successful in relation to the intellectual and financial investment that have been provided may reveal a less-than-ideal efficiency. Southwell (1995) noted that the then recent and current cognitive educational initiatives had not appeared to deliver tangible improvements, and the same observation may arguably be offered now, nine years on.

This does not imply the abandonment of cognitive research approaches. Nor does this question the relevance of cognitive theories of knowing and learning. Rather, this study recognises the inter-relatedness of cognition and affect, and proposes that a more balanced emphasis on affective aspects of mathematics education may reinforce the effectiveness of *both* fields of mathematics education research to optimise the mathematics teaching/learning experiences. In fact, as will be seen in Section 2.2.2, the notion of values will be defined in relation to the intersection between affect and cognition.

Thus, this will be as much a research study about immigrant teachers' socialisation as it is about the school mathematics curriculum in Victoria. This study will also be as much a contribution towards researching affect in mathematics education as it is about the role of cognition in affective inculcation and in mathematics teaching/learning. It will also examine ongoing value differences and conflicts, but at the same time, equally ongoing teacher negotiation of such differences and conflicts. The complementarity within each pair of factors is crucial ; meaning is constructed and negotiated in the context of the 'opposing' factors.

This study will be laid out in the following order. Following this introductory chapter, Chapter 2 sets up the theoretical framework against which this study will be conducted. This framework will be constructed from current knowledge in the fields of affective aspects of mathematics and of mathematics education, values related to mathematics and mathematics education, and teacher socialisation. Gaps in current research knowledge that are related to the study will also be identified, leading to the formulation of the

research questions guiding the conduct of this study. Chapter 3 will be concerned with the methodological design of this study. Results from the quantitative component of the study will be presented in Chapter 4, whereas the qualitative, main results will be described in Chapter 5. Chapter 6 presents a discussion of the results, from which some of the emerging ideas will be explored more theoretically in Chapter 7. The thesis will conclude with Chapter 8, which will also identify the implications identified through this study for both teacher practice and educational research.

The conduct of any (educational) research is necessarily a process, and it is the intention of this written presentation of the study to document the learning, reflection and researching that will take place over a period of time. As such, this presentation will be composed on an ongoing basis in order to capture the thoughts and ideas that come to the fore in the researching process. Accordingly, the reader will notice a shift in the use of the tense in this written presentation, from future tense in the planning stage of the study, to the past tense in the reporting sections.

Throughout this presentation of the research, the following conventions will be used. Firstly, whenever individual values are mentioned, these terms will be shown in italics font. Secondly, as have been encountered earlier in this chapter, references to countries and generic individuals will be accorded the female gender for convenience rather than to reflect bias in assumptions. Thus, for example, each of the teacher participants may be asked for the extent to which she values *technology* in the context of mathematics teaching and learning. Also, a glossary of acronyms used in this research report will be presented at the very back of this thesis report, to facilitate easy reference by the reader.

CHAPTER 2

THEORETICAL FRAMEWORK OF THE STUDY

In the previous chapter, the rationale and significance of conducting this study were discussed. Although this was made against the socio-cultural and educational contexts of mathematics education in Victoria, Australia, it is not hard to apply the same reasonings to cultures beyond the shores of Australia, in view of present-day demographic movements and changes across nations and cultures, and in view of (mathematics) curricula serving an increasingly integrated global economy.

This study — and the discussion upon which this study is based — is meaningful to the extent that mathematics and mathematics education are socio-culturally referenced, that administrators, teachers, students and parents' values regarding mathematics and mathematics education are constructs that influence their decisions, practices and actions relating to mathematics teaching and learning, and that socialisation experiences represent a huge impact on the quality of a teacher's professional life. Thus, this chapter will critically examine the following aspects of educational research to position the theoretical framework within which this study will be located:

— socio-cultural context of mathematics and mathematics education,

— values related to mathematics and mathematics education, and

— teacher socialisation.

In framing the current study from three different approaches and domains of knowledge, the three aspects above also emphasise the relationship and interplay between the teacher and her environment. In the case of the immigrant teacher, the context of this environment is drawn from both her home and host cultures. The immediacy of the potential for cultural conflicts for this group of mathematics education professionals is thus apparent.

In the light of the theoretical framework, and in consideration of the rationale for this study, the research questions will be formulated. These will be presented towards the end of the chapter.

2.1 Socio-cultural Context of Mathematics and Mathematics Education

2.1.1 Socio-cultural Context of Mathematical Knowledge

Rather than being a body of objective knowledge which exists 'out there' to be discovered, as is often perceived, mathematics is socialised knowledge which has been developed as a response to human needs (Cai, 1986; D'Ambrosio, 1990; Malmivuori, 2001). While the socio-cultural dimension of mathematical knowledge has gained increasing prominence over the last few decades, one significant area of development has been ethnomathematics, developed and researched by such scholars as Alan Bishop, Ubiratan D'Ambrosio, Gelsa Knijnik, Marcia Ascher, Paulus Gerdes, Rik Pinxten, and Robert Ascher. D'Ambrosio (1985) defined ethnomathematics as "the mathematics which is practised among identifiable cultural groups, such as national-tribal societies, labor groups, children of a certain age bracket, professional classes, and so on" (p. 45). In their editorial comments to Struik's (1997) chapter, Arthur Powell and Marilyn Frankenstein extended the meaning of 'ethno' to cover any "cultural group defined by a philosophical and ideological perspective" (p. 173). Through these developments, there has been a greater awareness and understanding of the socio-cultural nature of mathematics. Not only are different mathematical systems recognised as having been developed from their situatedness within different cultures, these are also shaped by the society within which any particular culture exists. These two aspects will be elaborated in the following paragraphs.

Mathematical knowledge did not originate from, nor does it belong to, any one particular culture. "Every people, every culture and every subculture, including every social group ... and every individual, constructs and develops its own, in a certain way *particular*, mathematics" (Gerdes, 1998, p. 47). Many ethnomathematical studies have demonstrated the existence of fascinating, yet efficient (Borba, 1997) and sophisticated mathematical systems in indigenous cultures such as in parts of Africa, of South America, and in Papua New Guinea. The development of these mathematical systems are linked to particular needs of the respective societies (Ascher & D'Ambrosio, 1994; Bishop, 1991; Knijnik, 1993) for the purpose of "encoding, interpreting and organising the patterns and relationships emerging from the human experience of physical and social phenomena" (Cooke, 1990, p. 5). For example, the Inca's use of quipu as a form of number record in

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South America in the 15th Century represents their way of meaningful symbolic representation in the context of their culture (Ascher & Ascher, 1994). On the other hand, culturally-unique mathematical systems may reflect the different world-views of particular cultures, such as that of the Navajo Indians (which is one of continuous events and processes, not one of discrete situations and objects) (see Pinxten, 1994). The practical need for a relatively more extensive range of words than there are in the English language to describe different types of hills by the Yindjibarndi language (spoken in the Pilbara region of indigenous Australia) reflects a different but culturally-relevant notion of spatial and navigational world-view. Also, the optical fibre industry adopts a standardised practice of rounding rules called 'even rounding', which is different from those often taught in schools and used in daily life (Fielding, 2003).

At a more fundamental level, one may also question the validity of equations as 'basic' as 1+2=3. That this equation is readily considered true reflects either a collectively-held paradigm, or our acceptance of an agreed system of conventions (eg base ten numeral system). In the former, this paradigm may be related to our taken-for-granted notion of the concept of addition, that is, as representing the action of laying the items 'side-by-side' rather than, say, perceiving addition as a form of fusion. Thus, the acceptance of $1 + 2 = 3$ as valid is also grounded in socio-cultural beliefs, norms and practices.

The more or less common canonical mathematics education received by learners in many countries around the world has probably led many to believe that 'real' mathematics is a 'western' invention. However, "[one] of the greatest ironies ... is that several different cultures and societies have contributed to the development of what is called western mathematics: the Egyptians, the Chinese, the Indians, the Arabs, the Greeks, as well as the Western Europeans" (Bishop, 1990, p. 61). Joseph (1993) also made a similar observation in his discussion of mathematical development from a historical perspective. Indeed, this feature in the development of 'Western' mathematics reflects the western Europeans' interactions with the rest of the world historically. It is reasonable to argue that the adoption of the essence of different cultures did serve their needs of making sense of their newfound neighbouring states and colonial countries.

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At the institutional level, we may find that the development and/or maintenance of particular branches of mathematics has a history of being subjected to the values of dominant groups such as politicians and research funding agencies. Operational research, for example, was developed out of military applicational needs in the Second World War (Martin, 1997). The same goes for games theory, in which

> the values of the modelers are incorporated into the game theoretical formulation, which usually ensures that the game gives results which legitimate those very same values. Game theory in this situation provides a "mystifying filter": values are built into an obstensibly value-free mathematical framework, which thus provides "scientific" justification for the decision desired. (Martin, 1997, p. 161)

Similarly, competition for limited available research funding has also meant that the direction of development of mathematical knowledge is influenced by priorities set by funding agencies, often with links to either governmental or commercial interests.

D'Ambrosio (1985) distinguished between academic mathematics and other kinds of ethnomathematics. Bishop (1988) referred to them as M and m respectively. Walkerdine (1997) considered mathematical knowledge as being produced within their respective discursive practices. In this context, Pinxten (1994) attributed the rise of M and the corresponding decline of m to the absolutist/formalist views on the nature of mathematical knowledge. In turn, this absolutist / formalist view may be motivated by the self-interests and job insecurity of some mathematicians which led to the promotion of 'pure' mathematics in a bid to establish "exclusive claim to control over the discipline" (Martin, 1997, p. 164). Pinxten proposed to establish a bridge between a pupil's m and the academic M on the argument that mathematical knowledge has its foundation in the contextual and cultural knowledge of everyday mathematics. In this way, learners' understanding can actually be strengthened by the contrast that is thus highlighted. For example, Nelson (1993) showed how comparison between the decimal numerical system and another number system unique to a particular culture may strengthen pupil comprehension of related concepts.

In addition to the nature of mathematics, the role played by mathematical knowledge in society is also socially constructed. That mathematics is the basis on which new knowledge often develops makes it a widely-used instrument as a social and educational filter since Greek times (D'Ambrosio, 1990). Skovsmose (1992) presented another angle

to this aspect of mathematics' role in the society, when he explained how mathematics has been used to modify behaviour through colonising part of reality and re-arranging it.

Available research literature, however, does not appear to address the issue of what this socio-cultural context of mathematical knowledge means for teachers practising across cultures. At least subtle differences exist in the ways different cultures shape and are being shaped by the different *mathematicses*, which also imply the different roles expected of — and emphases given to — mathematical knowledge. In this sense, then, immigrant teachers of mathematics may find themselves teaching or needing to teach a different mathematics in Australia. What are some of these differences, and how do these immigrant teachers deal with such differences?

2.1.2 Socio-cultural Context of Mathematics Education

These questions may be considered by turning our attention to school mathematics, in which the ways it is learnt and taught in schools are again subjected to socio-cultural influences. In fact, education in general (Veugelers & Kat, 2000), and mathematics education in particular (Cobb, 1996; Munro, 1996), are themselves socially-referenced activities. As Schmidt, McKnight, Valverde, Houang, and Wiley (1997) proposed, "school mathematics is mathematics as it is conceptualised, represented, structured, and sequenced to share with the next generation through the formal schooling experience" (p. 4). Even in classrooms where mathematics is taught with the utilitarian approach, that is, when mathematics is seen as essentially dissociated from society and acquired for its own sake and/or aesthetic value (Joseph, 1993), the mathematical knowledge being taught and learnt has its own unique cultural dimension (as discussed in the last section). Thus, whichever approach(es) to mathematics education is being adopted or adapted, the school mathematics curriculum inevitably reflects relationships between mathematics and the society to which this discipline is applied.

In Victoria, as in anywhere else, the development of the form and content of the state's mathematics curriculum has been subjected to socio-cultural (including political) forces (see Horwood, 1999, for a historical examination). For example, the diminishing role of teachers in shaping the state's mathematics curriculum in the late 1990s coincided with the formulation of a curriculum framework which reflects the liberal ideals of the then

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state government. Thus, what is included and excluded in the Victorian mathematics curriculum reflect prevailing social, political and pedagogical values. Similarly, the pioneering introduction of graphing calculators in the 1990s, and of computer algebra systems in the early 2000s, in the Victorian secondary mathematics curriculum demonstrate how the education authorities shape mathematics education reform in relation to foreseeable trends in the local and global economies.

Even with apparently similar mathematics curricula, different cultures may teach the content differently and with different approaches or perspectives, reflecting underlying socio-cultural values. A more specific example relates to studies conducted in the 1990s (Brenner, Herman, Ho & Zimmer, 1999) which showed how manipulatives were used differently in Asian and American classrooms. It was found that while manipulatives were often used to promote student establishment of linkages with abstractions in Asian classrooms, the same manipulatives were utilised in more concrete contexts in American classrooms. Thus, given that immigrant teachers had been socialised into the pedagogical cultures of their respective home countries, the necessary adjustments involved when they enter the Victorian mathematics classrooms will certainly evoke conflicts between internalised values and Victorian state/institutional values as reflected in local instructional guidelines/practices.

In fact, it may be pedagogically desirable to relate mathematics education to culture explicitly. Fasheh (1982) believed that this would enable pupils to know more about reality, culture, society and themselves, so that the level of awareness, criticism, appreciation and self-confidence among these pupils will be raised.

On the other hand, failure to relate mathematics teaching to culture can lead to lower understanding and negative emotions. The price of 'ignoring' the cultural aspect of mathematics education can be huge, as some developing countries have discovered. For example, mathematics education systems of developed nations have been influencing those in some Southeast Asian nations (Nebres, 1995). In fact Orton (1992) referred to the 'meticulous translations' of 'Western' mathematics in some developing countries around the world. That these countries continued to produce disappointing mathematics results was due to what Orton (1992) asserted to be a misfit between 'Western' mathematics and pupils' own cultures. Interestingly, the adoption of the mathematics

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education systems of developed nations reflected the influence of prevailing socio-cultural forces on mathematics education in each of these developing nations in the first place.

Thus, at the individual level, "all formal mathematics education is a process of cultural interaction, and that every child experiences some degree of cultural conflict in that process" (Bishop, 1994, p. 16). What the statement echoes, however, is the apparent research and academic focus on students and/or their learning experiences in the socio-cultural context of mathematics education. Certainly, research on mathematics learning in relation to such factors as ethnicity (e.g. Guberman, 2004; Malloy & Jones, 2002; Secada, 1992; Stevens, Olivarez, Lan, & Tallent-Runnels, 2004), socio-economic levels (e.g. Lubienski, 2001) and gender (e.g. Hanna, Kündiger, & Larouche, 1990; Leder, Forgasz, & Solar, 1996; Leedy, LaLonde, & Runk, 2003) is a reflection — if not an explicit acknowledgement — of the socio-cultural context of school mathematics teaching and learning. In particular, all 18 edited articles in the book, 'Changing the faces of mathematics: Perspectives on African Americans' (Strutchens, Johnson, & Tate, 2000) focussed on African American students' mathematical learning and achievement. But, the emerging issue is the extent to which teachers of mathematics have been supported in this context, in terms of how teachers' personality, ethnicity, gender and other socio-cultural characteristics may impact on the quality of school mathematics teaching. Related research such as those conducted by Duffy, Warren, and Walsh (2001), as well as by Madsen and Mabokela (2000), are relatively sparse. Further, there seems to be a greater concern with identifying categories of theoretical interests than inquiring into ways of supporting more effective practices of such teachers. Thus, there appears to be an assumption that effective teaching of school mathematics can take place in different cultures without the need to consider possibilities of pedagogical changes in planning and practice.

The following non-subject specific statement by Erickson (1997) highlights the potential for conflict arising from these differences, as well as the choices for action by teachers confronted by such socio-cultural differences:

> Differing social situations provide differing ecologies of relationships with other people. They evoke differing aspects of the individual's overall repertoire of ways of speaking .... As diverse persons show up in the scenes of daily life they bring their hetereogiossia [from the Greek meaning 'differing tongues'] with them. There can be affiliation as well as conflict across those cultural differences. And discourses can be contested; they can be interrupted or interrogated. When that

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happens the assumptions of the discourse become visible and available for criticism. If a person or a group were to change discourses in a conflict that would be to take a different stance in the world. One may feel as if that is not permitted or as if that is one's right. (p. 55)

The discussion in this section has sought to demonstrate how the teaching and learning of mathematics, like other school subjects, is a function of the socio-cultural context in which it takes place. The range and variety of cultural differences that are evident in such an educational context challenge teachers' actions and discourses. In particular, the unique professional and personal circumstances characteristic of immigrant teachers should be able to bring these to even sharper focus.

2.2 Values and their Role in Mathematics Education

The first theoretical framework examined the socio-cultural aspects of mathematical knowledge and mathematics education, in which several references to cultural values were made. This section will begin with an examination of how values may be regarded as an integral and distinguishing component of different cultures. This will be followed by an overview of current knowledge regarding values, specifically its relationship with other affective constructs and its role in human decisions and actions. This will lead to the establishment of the second theoretical framework, pertaining to the role of values in mathematics education.

2.2.1 Values and Culture

Discussions of culture — acknowledging its ongoing evolution, characteristics and functions — are invariably intertwined with considerations of values that are embedded in it. In fact, culture has been described as "an organised system of values which are transmitted to its members both formally and informally" (McConatha & Schnell, 1995, p. 81). Phelan, Davidson, and Cao (1991) defined culture as the norms, values, beliefs, expectations, and conventional actions shared within any grouping of individuals. As Rokeach (1973) commented,

Values, more than any other, is the core concept across all the social sciences. It is the main dependent variable in the study of culture. [sic] society, and personality, and the main independent variable in the study of social attitudes and behavior. (p. ix)

Theories related to values in particular are not new, and the notion of values has been explored in fields as diverse as anthropology (e.g. Kluckhohn, 1962), philosophy (e.g. Kohlberg, 1981; Rescher, 1969; Rokeach, 1973; Unger, 1990), psychology (e.g.

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McConatha & Schnell, 1995), religion (e.g. Kwast, 1992), organisational theory (e.g. Hall, 1994; Hofstede, 1997), and educational research (e.g. Allchin, 1999b; Chen & Ennis, 1996; Halstead, 1996; Hill, 1991; Nixon, 1995; Raths, Harmin, & Simon, 1987; Tan, 1997). Although it is possibly futile to attempt to look for common threads pertaining to characteristics of values amongst these different conceptions of values in the different research fields, it is nevertheless informative for our understanding to explore the similarities shared by a number of these conceptions, so as to build a basic, general understanding of values.

The notion of a value has been described variously as a construct (McConatha & Schnell, 1995), an ideal (Hall, 1994) which refers to the desirability (Kluckhohn, 1962; Raths et al., 1987), importance (Lemin, Potts & Welsford, 1994), preference (Hofstede, 1997; Rokeach, 1973), worthiness (Hill, 1991; Raths et al., 1987; Swadener & Soedjadi, 1988; Tan, 1997), priority (Hill, 1991), (moral) rightness (Nixon, 1995; Raths et al., 1987; Tan, 1997), or potential benefit (Rescher, 1969) of particular objects, phenomena, actions or goals. However, what is desirable, preferable, worthy, important, righ , or beneficial in one culture may not be equally so in another. Thus, while values are shared meanings, their meanings are probably understood and shared within individual cultures rather than applicable across different cultures. In this way, values can be viewed as being "distinctive of an individual or characteristic of a group" (Kluckhohn, 1962, p. 395). The following quote of Nixon (1995) further exemplifies the characterising function of values:

> Values take us, as individuals and groups, back to our roots for the purpose of reclaiming what is morally alive in our communal pasts; they trace old loyalties but point also to new possibilities for realising our own moral agency and for supporting that of others. They can, and do, lead to the exclusivity of tribal and ethnic nationalisms, but they are also expressed in innumerable acts of altruism and self-sacrifice. (p. 220)

Tan's (1997) consideration of values in science education also expressed this relationship explicitly. For her, values are seen to be

> part of the culture of a community, and help to guide the actions of its members toward each other and the community as a whole and toward other communities that may have different values. In some communities, the values extend to define the community or its members' relationship with nature, both living and nonliving. (p. 559)

Thus, values as cultural products may be seen to be "shared meanings which had captured in certain periods in history the collective experience of a culture" (Jurdak, 1999, p. 42). These shared meanings were articulated by Dutch social scientist Geert Hofstede

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in 1997, when he proposed a set of five value continua along which individual cultures can be uniquely defined. These five value continua are:

- power distance (from small to large),
- collectivism – individualism
- femininity (concern and preservation) – masculinity (being assertive and ambitious)
- uncertainty avoidance (from weak to strong)
- orientation in life (from short-term to long-term)

The first four dimensions of cultures were derived from an empirical study of values in the 1970s which involved more than 50 countries around the world. Incidentally, these four dimensions were similar to the four predicted by sociologist Alex Inkeles and psychologist Daniel Levinson in the mid-1950s. The fifth dimension was the brainchild of Michael Bond later in the 1990s, and was subsequently incorporated by Hofstede in his set of value dimensions.

In this sense, values are analogous to a set of lenses with which we interpret the world around us. Whereas visible practices such as rituals and symbols are external manifestations of culture, values make up the "core of culture .... [and they] are among the first things children learn — not consciously, but implicitly" (Hofstede, 1997, p. 8). The significance of values in defining cultures is also evident from a consideration of human needs. Rather than being culture-free, the type and variety of human needs (with the exception perhaps of basic, physiological needs for oxygen, rest, food and water) are generally dependent on particular cultures (Hofstede, 1997; Lee, cited in Kluckhohn, 1962). For example, self-actualisation at the top of Abraham Maslow's (1968, 1976) hierarchy of needs can have different meanings in collectivistic and in more individualistic cultures. Yet, "it is possible to see needs as arising out of the basic value of a culture" (Lee, cited in Kluckhohn, 1962, p. 426). Obviously, then, values must be culturally-referenced so that the needs which arise from these values are consistent or similar across similar cultures.

According to Hall (1994), "values mediate a human being's inner and outer worlds, and enable us to express our inner selves outwardly in our daily activities" (p. 35). The idea of values playing the mediating role is significant, for this implies that not only may

values be shaped by an individual's inner world to interpret the outer world, but also an acknowledgement of the outer world's role in shaping values to interpret the individual's inner world. Thus, while the interaction between an individual's inner and outer worlds potentially involves differences and friction, the individual's values play a part in restoring consonance in this process.

2.2.2   Values and Affective Constructs

The concept of values, however, can be a slippery one to define (Curriculum Corporation, 2003). Generally, as will be evident below, values are related to corresponding affective constructs such as feelings, attitudes and beliefs, that is, 'value indicators' as Raths et al. (1987) called them. One perspective regards values as being the more significant affective qualities such as interests, attitudes and beliefs, that is, values are essentially interests, attitudes or beliefs that stand out from the rest. For example, Hofstede (1997) regarded values as "feelings with an arrow to it: they have a positive and a negative side" (p. 8). Rescher (1969) saw values as being a significant set of attitudes: "a value represents a slogan capable of providing for the rationalization of action by encapsulating a positive attitude toward a purportedly beneficial state of affairs" (p. 9). Hill (1991) regarded values as a subset of beliefs, values being "those beliefs held by individuals to which they attach special priority or worth, and by which they tend to order their lives" (p. 4).

Another perspective evident in the research literature regarded values as occupying a more internalised and deep-seated position within the human psyche, such that values are responsible for "a persistent and consistent response to a family of related situations or objects" (Krathwohl et al., 1964, p. 166). Rokeach's (1973) reference to values as enduring beliefs (p. 5) is an example. Krathwohl et al's (1964) second set of 'taxonomy of educational objectives' (which focussed on the affective domain), perhaps presents a more well-known illustration of this perspective of values. The Taxonomy adopted a stage-learning perspective, positioning the learning of values at the apex. Values development was seen as a process involving different affective objectives located along a multidimensional internalisation continuum. The most basic stage is 'receiving (attending)', when the individual's attention is drawn to a phenomenon. Successive stages – the rest being 'responding', 'valuing', 'organisation', and 'characterisation (by value or value complex)' – involve increasing levels of internalisation, greater levels of internal

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control over the ownership of affective objectives, and increasing complexities and abstraction of these variables.

The involvement of cognition in the individual's cultivation of values is highlighted clearly in the valuing process involving 'value indicators', conceptualised by Raths et al. (1987). According to these researchers, a 'successful' valuing process involves the satisfaction of all the following seven criteria:

— choosing — freely
           — from alternatives
           — after thoughtful consideration of the consequences of each element
— prizing — cherishing
           — affirming to others
— acting — with the choice
          — repeatedly, in some pattern of life.

The relevance of some of these seven criteria are certainly debatable (see Seah, 1999; Stewart, 1987). For example, certain life experiences may create such deep impressions and strong impact on the individual that they shape or alter her outlook and attitudes to life — and indeed personal values — forever; thus, the criteria that values are acquired from choice may not apply in these instances. In fact, the availability of choice is a culturally-referenced value assumption which may be kept from public knowledge or which may remain an ill-afforded luxury in some cultures. In other words, while there are certainly values which are internalised through a conscious process (and which may well satisfy the seven criteria listed in the valuing process), the development of some values may well be subconscious to us. In fact, certain parts of the affective-cognitive reference system are "unconscious" to us (Schlöglmann, 2001). The notion of a process, though, is a useful idea with which values development may be considered. Value indicators are seen to be subjected to 'trials and tests' before becoming values. This agrees with the idea of increasing internalisation in Krathwohl et al's (1964) Taxonomy. Indeed, the valuing process as described by Raths et al. (1987) may be regarded as corresponding to the mid-level of the Taxonomy, i.e. the valuing level, at which values are accepted and committed to from amongst the range of less internalised, affective qualities.

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Thus, as a result of values representing greater levels of internalisation and internal control over the ownership of affective objectives, we can see values as being more stable compared to the value indicators. While an individual may experience changes in her own attitudes and/or beliefs throughout her life (see Perry, Vistro-Yu, Howard, Wong, & Keong, 2002), the individual's values do not normally undergo significant changes once they have become part of the personal value systems. Although most of these values may be acquired in the individual's 'character-forming' years as a child, it is reasonable to argue that significant life experiences at other times of the individual's life (such as migration, changes in medical conditions, and the addition/loss of loved ones) can exert pressures on the personal value system in ways which may well result in some basic and far-reaching changes.

A question which surfaces is, do values form an affective *or* cognitive construct? While the nature of values' relationships with beliefs and attitudes may suggest that values are affective qualities, the structure of the Taxonomy and the criteria listed in the valuing process do hint at a cognitive characteristic for values. Interestingly, in the description of the affective domain of their Taxonomy, Krathwohl et al. (1964) clarified that "the fact that we attempt to analyze the affective area separately from the cognitive is not intended to suggest that there is a fundamental separation. There is none" (p.45). In fact, the very notion of the affective domain was seen by McLeod (1989) to be "a wide range of feelings and moods that are generally regarded as something different from pure cognition" (p. 245), thus hinting at a certain level of cognitive involvement in affective factors. Similar propositions about the inseparable affective-cognitive facets of the human psyche have also been made more recently, such as by Schlöglmann (2001) and Seah (2001). Schlöglmann (2001) explained how the operations of Jean Piaget's adaptation strategies (i.e. assimilation and accommodation) involve the interplay between cognitive and affective processes. For example, the role of affect in cognition is seen in this statement: "affects .... provide the energy through which cognitive processes are motivated or hindered. They control attention and memory processes, and influence the hierarchy of cognitive schemata" (Schlöglmann, 2001, p. 2).

Drawing on the Eastern perspective on being and relating, and the associated concepts of equilibrium and harmony, Seah (2001) viewed the human affective-cognitive system as

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being made up of four interlocking components, namely thinking about thinking, feeling about thinking, feeling about feeling, and thinking about feeling. From this perspective, values were perceived to make up the 'thinking about feeling' component. More importantly, there is the implication of a complementarity between affect and cognition, and what is commonly regarded as affective or cognitive in character may simply be a recognition of the differing degree to which each of these components is emphasised in reality.

In other words, it may be more useful for our understanding of human experiences if we consider cognitive-affective constructs instead. While beliefs, attitudes and emotions may be predominantly affective in nature, there exists also a cognitive component, whose strength and influence may probably decrease from beliefs to attitudes, to emotions. As highlighted in McLeod's (1992) review of research on beliefs, attitudes and emotions, these qualities may be distinguished by

> the degree to which cognition plays a role in the response, and in the time that they take to develop. .... Therefore, we can think of beliefs, attitudes, and emotions as representing increasing levels of affective involvement, decreasing levels of cognitive involvement, increasing levels of intensity of response, and decreasing levels of response stability. (pp. 578-579)

Thus, does it follow then that we can postulate these to include values, implying that the increasing level of internalisation related to values corresponds to an increasing level of cognitive involvement (and a corresponding decreasing level of affective involvement) as well? Could the level of affective involvement in values formation be so low that the construct of values was left out of McLeod's (1992) review of research on affect in mathematics education, such that Jurdak (1999) considered values as "psychological constructs that students and teachers have formed as a result of cumulative individual and collective contextualized experiences" (p. 41)? It is also evident when Kluckhohn (1962) referred to values as 'conceptions', when Krathwohl et al. (1964) related the corresponding categories in their cognitive and affective taxonomies, when Swadener and Soedjadi (1988) referred to a value as "an idea or concept" (p. 197), when McConatha and Schnell (1995) linked values to "constructs", and when Raths et al. (1987) perceived valuing as involving the activities of choosing, prizing and acting, that the internalisation of the affective ideas that constitute values is indeed a highly cognitive activity.

The relative dominance of cognition and affect in relation to values is likely to be different depending on what aspect of values is being considered. That different people or cultures attach different importance to values such as *thrift* and *respect* is indicative of the affective nature of these ideas. As is seen in the last paragraph, the process of acquiring these values can be regarded as more cognitive than affective. Yet, we often come across stories of people risking their own lives without hesitation to save others', or of people reaffirming their values through reacting strongly to particular stimulus. In other words, value activation is likely to be more affective than it is cognitive.

It may be appropriate at this stage to discuss the relationship and difference between the constructs of values and beliefs. After all, beliefs represent the next less internalised construct in the continuum of cognitive-affective constructs, and there has been a large amount of educational research on beliefs. Establishing a distinction between values and beliefs would thus shed light on how current knowledge of beliefs may be utilised in helping us understand better the nature of values.

Unfortunately, the difference between values and beliefs is not always made distinct in the research literature. Even regarding values as representing a more internalised form and a greater cognitive involvement than beliefs does not necessarily lead to any observable difference between the two constructs at all. In fact, we often come across the terms 'values' and 'beliefs' being used interchangeably, as if they are different labels for the same construct, such as in religious values/beliefs.

The seven criteria in the valuing process proposed by Raths et al. (1987) can be used to represent a systematic approach to distinguishing values: a belief evolves into a value only when it satisfies *all* seven criteria of the valuing process. In particular, the anthropologist Clyde Kluckhohn made the point that "values differ from ... beliefs ... by the commitment to action in situations involving possible alternatives. If you are committed to act on a belief, then there is a value element involved" (Kluckhohn, 1962, p. 432). Clarkson and Bishop (1999) perceived values as beliefs in action, thus also emphasising the notion of observable, behavioural aspect of values, similar to the acting element in the valuing process mentioned above. All these perspectives relate valuing to a volitional aspect, yet these underlie an assumption that values are necessarily acted upon. This may well be true considering particular values alone, but in the context of many

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values that are often involved in any life experience, there are surely times when not everything that is valued can possibly be demonstrated at the same time. Does this mean then that there are possibly priorities amongst values, which challenges the notion that values represent affective constructs that are acted upon?

Kluckhohn (1962) attached beliefs to the categories 'true/false' and 'correct/incorrect', and values to 'good/bad'. This reference to values as indicative of one's notion of what is good has also been referred to in later years in definitions of values by Nixon (1995) and Tan (1997). Rokeach (1973) introduced an additional dichotomy 'desirable/undesirable' to refer to values, and held the opinion that considering something as good or bad essentially represents the articulation of a belief. Likewise, describing values as those ideas that are perceived to be important in life (Lemin et al., 1994) also reinforces their affective and subjective nature. Based on these views, it validates once again the cognition-affect balance in values development and activation as discussed earlier. A way of distinguishing values and beliefs in observable ways may thus be proposed here. The judgement of the truth, correctness or goodness of any phenomenon is only possible and meaningful when it is situated in some context. A belief that 'mathematics is fun' concerns a true/false (and not possibly a good/bad) judgement, a judgement which can only be meaningfully made based on an object, i.e. the subject of mathematics. Holding this belief does not mean believing that any other school subject, or any other thing, is necessarily fun. On the other hand, in the case of values, the notion of what is or is not desirable or important in life does not necessarily require any specific target object. A person who subscribes to the value of *fun* will look for it and/or emphasise it in her daily life. It is an idea which is desirable or important in a somewhat universal way. Values, then, would appear as single terms which are context-free. An examination of values listed in curriculum frameworks and in national value statements reflects this feature of values, some of which are listed in Table 2.1.

Since this tangible distinction can be very useful for the purpose of identifying values, it is worth noting too that values may be seen to differ from attitudes in the similar way. Thus, if an individual's attitude is one of interest or curiosity, it is also expected that she is not interested or curious towards everything around her. Rather, like beliefs, these attitudes are associated with particular objects, events or phenomena. So, she may be

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interested in swimming and in the language arts, and/or curious about science, for examples.

In Rokeach's (1973) words, values are transcendental (across objects and situations). Similarly, Krathwohl et al. (1964) refer to values in the personal value system to be "broadest with respect both to the phenomena covered and to the range of behavior which they comprise" (p. 185).

Similarly, the way in which Chin, Leu and Lin (2001) differentiated between their 'pedagogical identities' (i.e. expressed in the form of words) and 'pedagogical identifications' (i.e. expressed in sentences) (Chin, 2001, personal communication) also supported the notion of values (the former) as being decontextualised beliefs (the latter). This distinction also supported the idea that each value often develops from an interaction amongst several beliefs, reflecting the internalisation continuum in the taxonomy of Krathwohl et al. (1964), and the seven-criteria valuing process of Raths et al. (1987).

While values may derive from interests, attitudes, beliefs and the like, they also exert "a direct or indirect influence on attitudes, beliefs, feelings, and the perception of the social and political world" (McConatha & Schnell, 1995, p. 80). "Values form the basis of a person's ... attitudes toward others and toward the world at large" (Tan, 1997, p. 559). They play a role in one's subsequent response to social stimuli in a general sense, i.e. in one's affective notions in the forms of interests, attitudes and beliefs. Senger (1999) alluded to this when she acknowledged the presence of underlying values in beliefs. Thus, while values may be considered as significant or internalised attitudes and beliefs, they also subsequently foster the continual and/or wider adoption of other related attitudes and beliefs. As emotions, attitudes, beliefs and values are activated in new and wider areas of personal experience, new emotions, attitudes, beliefs and values may be fostered as well, thus leading to an increasingly complex and intertwining system of what Schlöglmann (2001) called personal affective-cognitive reference systems.

Table 2.1

Values Articulated in a selection of Curriculum Frameworks and National Statements

Curriculum frameworks		
Western Australia Curriculum Framework (Western Australia Curriculum Council, 1998)	32 core shared values: • The pursuit of personal excellence • Domains of human experience • Empowerment • Knowledge • Values systems • Critical reflection • World views • Individual uniqueness • Personal meaning • Ethical behaviour and responsibility • Openness to learning • Initiative and enterprise • Compassion and care • Equality • Respect • Open learning environment	• Individual differences • Cooperation/Conflict resolution • Family/home environment • Participation and citizenship • Community • Diversity • Contribution • Authority • Reconciliation • Social justice • Responsibility and freedom • Benefits of research • Cultural heritage • Conservation of the environment • Sustainable development • Diversity of species
Values Education Study (Curriculum Corporation, 2003)	10 shared values to be fostered by • Tolerance and understanding • Respect • Responsibility • Social justice • Excellence	Australian schools • Care • Inclusion and trust • Honesty • Freedom • Being ethical
Manifesto on values, education and democracy (South Africa Department of Education, 2001)	• Democracy • Social Justice and Equity • Equality • Non-Racism and Non-Sexism • Ubuntu (Human Dignity)	• An Open Society • Accountability (Responsibility) • The Rule of Law • Respect • Reconciliation
National statements		
Malaysia's Nilai-nilai Murni (Tan, 1997)	16 noble values: • Compassion • Self-reliance • Humility • Respect • Love • Justice • Freedom • Courage	• Physical and mental cleanliness • Honesty • Diligence • Cooperation • Moderation • Gratitude • Rationality • Public-spiritedness
Singapore's Shared Values (Singapore Government, 1991)	• Nation before community and society above self • Family as the basic unit of society	• Community support and respect for the individual • Consensus, not conflict • Racial and religious harmony

2.2.3 Values and Action

Values, like beliefs and attitudes, manifest themselves as views and behaviour (Veugelers & Kat, 2000). Since values are more significant or more internalised than emotions, attitudes and beliefs, the relationship which values have with human decisions and actions should be a stronger one compared to the other affective constructs. To what extent, then, are teacher actions guided by their values? The classroom is a place where a large number of (mostly on-the-spot) decisions are made; research (Orlich, Harder, Callahan, Kauchak, Pendergrass, Keogh, & Gibson, 1990) has shown that elementary teachers deal with as many as 1 000 classroom interactions daily, most of which involve minor and major decision-making. In our day-to-day dealings with events and phenomena, "rational choice must not be random but guided by considerations of comparative merit, considerations in which values must play a pivotal role" (Rescher, 1969, p. 45; see also McConatha & Schnell, 1995). However, this important role of values needs not imply a necessary translation into actions that correspond to values subscribed. Hill (1991) cautioned that the volitional aspect of values may not necessarily follow from the cognitive and affective aspects. Furthermore, there have been observations that similar situations often lead to several possible and often incompatible responses (Raths et al., 1987). In fact, "since a given situation will typically activate several values within a person's value system rather than just a simple one, it is unlikely that he [sic] will be able to behave in a manner that is equally compatible with all of them" (Rokeach, 1973, p. 14).

For example, a teacher may find that the school expects its staff members to propagate certain identified values in its 'value of the week' program, and this teacher may well find that it is in her professional interest (to retain the job, perhaps?) to suppress the portrayal of certain other personally-held values. On the other hand, immigrant teachers who experience racism in their respective workplace may also respond in ways only so as to 'act mainstream'.

As another example, a mathematics teacher may value opportunities to stimulate her pupils to develop breadth in the mathematics content taught in class, to relate a particular mathematics theorem/formula to its historical/cultural evolution, to help pupils see its

applications in the society, and to challenge them to establish novel applicational links. This same teacher may also value the importance of pupil academic excellence in mathematics, especially in high-stakes examinations for tertiary entry. How is this teacher going to plan for a particular topic with the five or six periods allocated in the school teaching plan? Time constraints do not afford this teacher with the luxury of emphasising both *enrichment* and *practice*, for instance. 'Competing' values are involved in these examples, and the teacher has to base her decisions and actions on relevant competing values. Pressure from competing values in classroom interactions also come about as "teachers and children negotiate over the parameters of a working consensus – a set of understanding which allows for mutual survival" (Pollard, 1982).

For any teacher, it is unlikely that the priorities among competing values will remain the same across situations and contexts. These values override one another differently in different contexts. After all, in different situations, constraints and goals can be different, resulting in the activation of different sets of competing values, which thus lead to different choice of actions.

It is worthwhile noting that the notion of competing values is not entirely novel in the research literature. Hofstede (1997) talked about conflicting values experienced by people, which "make it difficult to anticipate their behavior in a new situation." (p. 11). He quoted an example in which students in masculine cultures may be characteristically vocal in class and compete openly with peers, but such characteristics may not always be observed when this student enters another masculine society, which also subscribes to collectivist values. The science teacher participant in Lewis-Shaw's (2001) study experienced "tension between ... [the] sometimes competing priorities" (p. 186) between communication of subject content and interest/concern for students, due to such factors as time constraint.

In his philosophical discussion of values in education, Webster (2002) proposed that many teachers who claim to value *honesty* are also likely to necessarily lie at times (to students). It thus appears possible for an individual to value both *honesty* and *dishonesty*: "their usefulness to us as educators is determined by our relation to them, that is, how we as agents *value* their potential as we pursue our personal aims of our educational enterprise" (p. 4). This view, however, appears to accord values with meanings in context,

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which runs counter to our earlier distinction that values are context-independent and transcendental. Yet, we do find ourselves being honest and dishonest in different situations! The notion of competing values may be useful here to resolve this 'tension'. Using Webster's (2002) example, an individual may value *honesty* and she may still lie to students that she is unable to solve a given problem "in order for them to adopt a less dependant approach to their problem solving and learning" (p. 4). What this quoted phrase implies, then, is possibly the affirmation of a competing value, say, *independence*. In such a situation, it is likely that *honesty* and *independence* are both valued by the individual, and that the latter dominates the former in situations when she is observed to be dishonest.

On the other hand, competing values may not all be of equal significance with respect to the context being considered. Hall's (1994) categorisation of values into phases and stages implied that "generally speaking, the phase and stage of the value given first priority determines the world view of an individual or group" (p. 67). These more prioritised values may be called 'overriding values'. Due in part to the fact that they are so much a part of the individual, overriding values may be activated without her conscious forethought (Krathwohl et al., 1964). So, we saw how the values of *respect* and *individual needs* were overriding values probably possessed by Fay, a teacher participant in the 'Values And Mathematics Project' (FitzSimons, Bishop, Seah, & Clarkson, 2001), values which were so deep-rooted in her personality that she did not nominate those during the pre-lesson interviews.

Both the notions of competing and overriding values imply that individual values alone do not influence the nature of human decisions, actions and responses. Rather, it is the role of the value system, "a learned organization of principles and rules to help one choose between alternatives, resolve conflicts, and make decisions" (Rokeach, 1973, p. 14). In fact, Bishop and Whitfield (1972) observed that "teacher's own value system is fundamental" (p. 16) to their prioritising of decisions in the classroom. Functionally, Rokeach (1973) explained:

> through experience and a process of maturation, we all learn to integrate the isolated, absolute values we have been taught in this or that context into a hierarchically organized system, wherein each value is ordered in priority or importance relative to other values. (p. 6)

By considering value systems/complexes (named variously as 'values schemas' (Hamberger & Moore, 1997), and 'affective-cognitive reference systems' (Schlöglmann, 2001) instead, we may be in a better position to explain the inconsistencies observed in several studies between individual beliefs and subsequent actions (see, for examples, Gondoseputro, 1999; Raymond, 1997; Schoenfeld, 1989; Sosniak, Ethington, & Varelas, 1991; Thompson, 1992). A likely explanation for such apparent inconsistencies is that while the individual may subscribe to the individual beliefs (and their underlying values), they may be prioritised differently in relation to one another in different contexts. Thus, what is actioned in any one context reflects the overriding or the prioritised competing value that is functioning in that context. The consideration of values as being organised in a system is crucial to this understanding.

Another factor behind observed inconsistencies between beliefs, attitudes and values on the one hand, and teacher practices on the other, may be due to what Tripp (1993) called second-hand values (see, also, 'reflected values' in Lewis-Shaw, 2001), values which had been articulated by more experienced colleagues and peers for example, and which may be implemented by a teacher in need of an immediate on-site response at a particular critical incident. Second-hand values do not normally form part of a teacher's value system, however. Teacher reflection should facilitate an appraisal of the second-hand values in relation to the action. "The processes of review and evaluation provide for on-going assessment of the effects of particular forms of action on self and on specific interests" (Pollard, 1982, p. 35). There are certainly opportunities for the teacher's personal value system to be fine-tuned in the process, beginning with a positive attitude to, or belief in, the desirability of the second-hand value. In time, this represents one way in which a person's ongoing developing value system responds to new insights and phenomena in the world around her.

Such second-hand influences have also been documented as beliefs and observed in students. For example, Carpenter, Lindquist, Matthews, and Silver (1983) reported that student inconsistencies in stated beliefs "reflect the beliefs of their teachers or a more general social view rather than emerge from their own experience with school mathematics" (p. 657).

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Lin and Chin's (1998) study with an experienced senior high school mathematics teacher demonstrated how the influence of second-hand values contributed to the teacher's professional development in this area. For this teacher, experts' (textbooks') values were accepted and portrayed to the pupils wholesale, before these interacted in time with the teacher's own values to bring about further development of his own unique teaching style. In this instance, teacher reflection — as part of the teacher's three-stage personal professional development (i.e. accepting experts' values, reflecting with own views, developing own unique style) — was very much also an evaluation of second-hand values (i.e. values espoused in textbooks).

Even though values may be more significant to — or more internalised within — an individual, an awareness and knowledge of these values within the individual's personal value system is unlikely to offer reliable prediction of how the individual responds to situations in daily life. The functioning of competing values emphasises the capability of the individual to respond in ways which match these to the specifics of the situation at hand. At times, overriding values gain prominence such that they determine the course of decisions and actions. At some other times, second-hand values play a role too. Thus, although values shape our interpretative schema, they only provide "abstract frames of references for perceiving and organizing experience" (McConatha & Schnell, 1995, p. 80) and are essentially "a form of conceptual and emotional goggles" (Tan, 1997, p. 559). In other words, values influence rather than determine the choice of possible actions available to an individual (Ennis & Chen, 1995; Hill, 1991; Hofstede, 1997; Kluckhohn, 1962; Nixon, 1995; Raths et al., 1987; Tan, 1997).

This discussion on the nature of competing, overriding and second-hand values in relation to value systems is important for the conduct of this study. It potentially facilitates a fuller understanding of how the teacher participants' different values interact with one another in the context of the perceived value differences. The notion of second-hand values is also a worthwhile interpreting tool as these may well reflect immigrant teachers acting in ways that are perceived to have been effective or appropriate in the host culture.

2.2.4 Value Change

That values are deeply internalised qualities within humans does not rule out the fact
that an individual's values may — and can — undergo changes. Krathwohl et al's (1964)
'taxonomy of educational objectives (affective domain)', as well as Senger's (1999)
model, both identified human awareness as the basis upon which affective variables gain
stability and are increasingly internalised. Thus, unless an individual ceases to be aware of
what is around her, life experiences will continue to shape the individual's attitudes,
beliefs and other value indicators, thereby putting pressure on the nature of the
individual's existing value system. Value change and a subsequent re-organisation of the
individual's value system brought about by this finetuning process are thus inevitable. As
mentioned by Raths et al. (1987),

> since we see values as growing from a person's experiences, we would expect that different
> experiences would give rise to different values and that any one person's values would be modified
> as those experiences accumulate and change .... And a person who has an important change in
> awareness or in patterns of experience might be expected to modify his or her values. Values may
> not be static if a person's relationships to the world are not static. As guides to behavior, values
> evolve and mature as experiences evolve and mature. (p. 198)

In fact, the causal factors underlying value change had been examined in greater depth
by Rescher (1969) during the same time that David Krathwohl's team constructed the
taxonomies of educational objectives. Rescher (1969) categorised value change as either
derivative or direct. Derivative value change applies to a subsidiary or means value when
the corresponding higher-order or end value undergoes a change itself. On the other hand,
direct value change may be induced by newly discovered or acquired factual information,
ideological/political change, a reaction to boredom/disillusionment, and most relevant for
his discussion in the book, value change caused by changes in the society's operating
environment, i.e. "the whole range of social, cultural, demographic, economic, and
technological factors that comprise the way of life in that society" (p. 177).

Despite the possibilities for one's values to undergo change, the fact that values are
more internalised than affective constructs such as beliefs and attitudes implies that any
value change may not be as dramatic, easy, and/or frequent as, say, attitude or belief
change. Value change has tended to be evolutionary (as opposed to revolutionary), and
many values (such as virtues like *honesty*) have actually withstood the test of time to

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remain stable, resilient and cherished by generations of the human race (Nixon, 1995; Rescher, 1969).

In the context of this study, the possibility for new values to be acquired and current values to be modified in form and degree of internalisation provide immigrant teachers with a level of flexibility in making sense of and negotiating perceived value differences. It suggests that values which these teachers view as being local/Australian need not be either rejected or accepted wholesale. Taking into account also the relationships amongst values, the process of value difference negotiation becomes problematised, although it may be a blessing that the individual has opportunities to resolve value difference situations in a variety of ways. The contribution of this study is in framing these opportunities to empower individual immigrant teachers in their professional practice in school mathematics teaching.

2.2.5 Values in Mathematics Education

Certainly, the teaching and learning of mathematics in schools have traditionally been considered in terms of cognitive processes. It was perhaps with the development of the constructivism paradigm in education, and the emphasis on problem-solving activities in mathematics pedagogy, that questions related to factors regulating or facilitating effective mathematics learning were asked, which in turn led to a focus on such affective qualities as beliefs (Malmivuori, 2001). One of the first definitions of values pertaining to mathematics teaching and learning was proposed by Bishop (1996), who defined values in relation to socio-cultural influences. The relative permanence of values has implications for a more effective values education program in general, and the optimisation of mathematics teaching and learning in particular:

> Values in mathematics education are the deep affective qualities which education aims to foster through the school subject of mathematics. They appear to survive longer in people's memories than does conceptual and procedural knowledge, which unless it is regularly used tends to fade. (Bishop, 1996, p. 19)

Soedjadi (2004) regarded the teaching of values in the mathematics classroom as an important component of a mathematics teaching process that covers cognition, affect and psychomotor. On the other hand, Chin and Lin (1999a) related values in the mathematics classroom to teacher identity, reflecting Halstead's (1996) association between values and

personal identity:

> values as social and individual phenomena, therefore, are conceived ... as teachers' pedagogical identities concerning mathematics, teaching, learning, and curriculum. They reveal the principles or standards of teacher selections and judgements on the importance or worth of using certain pedagogical identifications in his or her classroom teaching of mathematics. (Chin & Lin, 1999b, p. 317)

They elaborated further that mathematics teachers' values are "their *Pedagogical identities* concerning mathematics and pedagogy, developing through a dialectical relationship between the varieties and complexities of individual pedagogical identifications" (Chin, Leu, & Lin, 2001, p. 254). Here, Chin (personal communication, August 10, 2001) referred to 'pedagogical identities' as teachers' underlying principles which are normally expressed "in short words, for example 'individual thinking'", whereas 'pedagogical identifications' were referred to as teachers' propositions about mathematics and its teaching whose forms are usually "a bit long and [in] complete sentence for example 'There is no learning if students do not think'". As discussed earlier in Section 2.2.2, this distinction is in line with the idea that values are developed from beliefs, and that values transcend across objects and situations, whereas beliefs are contextualised in them.

The two experienced teacher participants reported in Chang (2001) gradually reverted to 'traditional teaching' despite being trained in 'constructivist teaching' during in-service professional development courses. That this was attributed to "a few core or deep ... values" (p. 295) reflected the deep-rootedness and influence (over action) of personal internalised values in the mathematics classroom.

In consideration of existing definitions of values in school mathematics and other disciplines (see Sections 2.2.1 and 2.2.2), I propose the following as the operational definition of values in this study:

Values represent an individual's internalisation, 'cognitisation' and decontextualisation of affective constructs (such as beliefs and attitudes) in h⌐ socio-cultural context. Values related to mathematics education are inculca. through the nature of mathematics and through the individual's experience in the socio-cultural environment and in the mathematics classroom. These values form part of the individual's ongoing developing personal value system, which equips her

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with cognitive and affective lenses to shape and modify her way of perceiving and interpreting the world, and to guide her choice of course of action. They also influence the development of other affective constructs related to mathematics education and to life.

Having defined values related to mathematics education in the manner above, let us now consider current research knowledge of the types and nature of such values, and of how some of these might be related to one other. In exploring values encountered in the mathematics classroom, Bishop (1996; 1998) identified three relevant categories — general educational, mathematical, and specifically mathematics educational:

> For example, when a teacher admonishes a child for cheating in a test, the values of 'honesty' and 'good behaviour' derive from the **general educational** and socialising demands of society. Then when a teacher proposes and discusses a task such as the following: "Describe and compare three different proofs of the Pythagorean theorem" the **mathematical** values of 'rationalism' and 'openness' are being conveyed. However there are other values being transmitted which are specifically associated with the norms of the institutions within which **mathematics education** is formally conducted. For example, consider the following instructions from the teacher: "Make sure you show all your working in your answers", "Don't just rely on your calculator when doing calculations, try estimating, and then checking your answers", the values implied are all about 'examination-wisdom' and 'efficient mathematical behaviour'. (Bishop, 1998, p. 34)

In particular, Bishop (1988) discussed that 'western' mathematical values can be conceived as being made up of three pairs of complementary values, i.e. *rationalism* and *objectism*, *control* and *progress*, *openness* and *mystery* (see Bishop, 1988, chap. 3 for details). The two values in any pair are complementary in the sense that although they appear to contradict each other in nature, they are both embedded and portrayed in mathematical knowledge. For example, "one of the paradoxes of Mathematics is that even though Mathematical culture brings with it the values of 'openness' and accessibility, people still feel very mystified about just what Mathematics is" (Bishop, 1988, pp. 77-78).

Mathematics educational values, too, may be seen to constitute complementary pairs. Seah (1999) identified the following in his textbook analysis study: *formalistic* versus *activist* view of mathematics learning (see Dormolen, 1986), *instrumental* versus *relational* understanding and learning (see Skemp, 1979), *relevant* versus *theoretical* nature of mathematics teaching and learning, *accessibility* versus *specialism* of mathematics knowledge, and utilising mathematical skills as part of a *process* versus as a *tool*. These categories were also used by Brown (2001) in his examinations of values in

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mathematics assessments. In fact, Brown went further, classifying these values into either pedagogical or cultural mathematics educational values.

General educational, mathematical and specifically mathematics educational values do not exist mutually exclusive of one another. Some values fit into two or all three of the categories. For example, *progress* and its associated value of *creativity* can be as much a mathematical and mathematics educational value as a general educational value (depending on the socio-cultural context in which this is understood). Also, when Taplin (2001) wrote about ways through which teachers can integrate values education into existing mathematics lessons, she was referring to a range of human values such as *perseverance, teamwork* and *truthfulness* — being both general educational and mathematics educational in nature.

As mentioned above, that culture and values are closely related means that the nature of any given value in the mathematics classroom is relative to its socio-cultural setting. As an example, the value of *rationalism*, with its characteristic promotion of logical thinking and deductive reasoning, may belong to each of the three categories of values in the context of a typical Western society. On the other hand, it may not be a socially desirable value in some other different cultures, where a promotion of *rationalism* in the population may be perceived as a threat to societal and/or political stability.

As another example of the socio-cultural nature of valuing, appropriate behaviour between dating students in a mathematics class may constitute a general educational value for some teachers, while it may well not be for others. The following quote sums up the related experience of an ethnic minority teacher beginning his professional practice in the Victorian secondary (mathematics) classroom, when he intervened in a classroom incident that saw a male student kissing his classmate-cum-girlfriend on the neck:

> examining my own attitude towards sexuality of myself and others, I was able during my teaching to be neutral in the sense that the students were like my own kids, what I found out though is that I am very conservative and protective when it comes to sexuality and that my own values and standards (and religious beliefs to a certain degree) have a major role and that it was something that I would not change and that mainstream teaching standards by large (at least in the school I taught at) agreed with me.
>
> That also meant that I might be faced with other contexts where possibly the school have made acceptable practice one or more things that I might strongly disagree with and that I should be prepared to face up to that and take my decisions accordingly. (Ali, personal communication, October 20, 2004)

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In the mathematics classroom, general educational, mathematical and mathematics educational values may be portrayed through the operating functions of teachers, textbooks, curriculum frameworks, etc. These can also be communicated through (more implicit) supporting values, which include the implicit message portrayed by teacher dressing (Neuman, 1997, chap. 14), textbooks' physical designs, teacher tolerance towards student late submission of work, for examples.

Drawing on Billett's (1998) five levels of knowledge genesis, values in the mathematics classroom may be posited partly within increasingly larger contexts of personal, institutional, epistemological and societal values, as shown in Figure 2.1.

Figure 2.1. Relationship of values encountered in the mathematics classroom.

math^cal values	—	mathematical values
m.e. values	—	mathematics educational values
g.e. values	—	general educational values
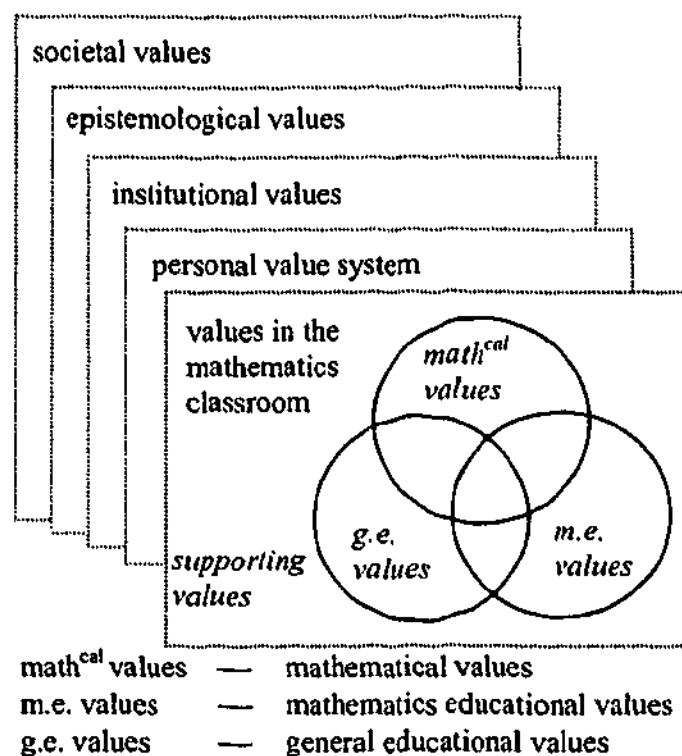
In particular, epistemological values refer to those values which are continually being constructed and modified by mathematicians or mathematics education researchers. For example, the value of *technology* may be relevant in Victoria as its importance continues to be reconceptualised in the context of the nature of mathematics. Similar categories have been discussed with reference to science education variously as 'epistemological and supporting values' (Tan, 1997) and 'values of science and research ethics' (Allchin, 1999b).

Note that the boundaries of the different set of values have not been represented by solid lines; this reflects the belief in a two-way permeability of the influences amongst values. For example, institutional values shape values in the mathematics classroom as much as values in the mathematics classroom influence the development of institutional values.

Neither is any set of values situated wholly within a 'larger' set of values, that is, each family of values is not a subset of some family of more general values. To explain/interpret this, consider a zoom-in view, as shown in Figure 2.2. The shaded area

Figure 2.2. Value differences (shaded).
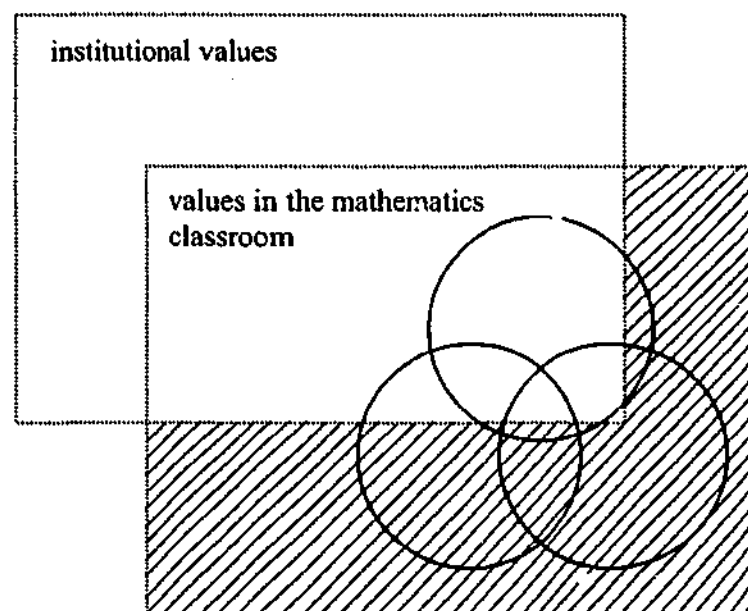
represents all the values in the mathematics classroom which are 'at odds' with institutional values in any particular cultural setting. These values, which are possibly brought into the classroom by both students and teachers, reflect differences between what are valued by students/teachers and what are valued by the institutions. They could also be reflecting value differences among the students/teachers themselves. For this study, it may thus be assumed that value differences perceived by the immigrant teachers involve the interaction of values in and out of the shaded areas within the classroom context. Thus, in an increasingly multicultural classroom of today, how the value layers overlap over one another will determine the extent to which cultural differences are perceived by both teachers and students.

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Empirical research studies into values relating to mathematics teaching/learning appear to be conducted in earnest from the late 1990s (see Bishop, Seah & Chin, 2003 for details). Some of these studies focussed on comparisons of values inherent in or portrayed between the intended and implemented curricula (Lim & Ernest, 1997), or between the implemented and attained curricula (Chin & Lin, 2000b). Tirosh and Graeber (2003, Section 2) provided an overview of research that demonstrated how changes in values and beliefs relating to all three facets of the curriculum have led to changes in teachers' practice in the mathematics classroom. Many more research studies explored cross-cultural differences in the values portrayed in the intended curriculum (Cao, Nguyen & Bishop, 2002; Cao, Seah & Bishop, 2002; Seah, 1999), implemented curriculum (Chang, 2000, 2001; Chin & Lin, 1999b, 2000a, 2000b; Leu, 1998, 1999; Leu & Wu, 2000, 2001; Lim & Saleh, 2002; Seah, Bishop, FitzSimons, & Clarkson, 2001), or attained curriculum (Brown, 2001).

In particular, two nationally-funded research projects (the 'Values and Mathematics Project' in Australia, and 'Values in Mathematics Teaching' projects in Taiwan) had been involved in researching values related to mathematics teaching/learning. Remarkably, both projects went beyond documenting observed values to mapping teachers' practice from the perspectives of evolving values and of the relationships amongst personally-held values. This current research study continues this approach; by researching with immigrant teachers, however, this study accentuates the cultural difference that stimulates value difference, so as to better understand the *process* involved in facilitating teacher portrayal of values that arises from addressing the dissonance perceived.

2.3 Teacher Socialisation

This chapter has so far discussed how the nature of mathematical knowledge and of mathematics education are socio-culturally-based, and how values related to mathematics and mathematics education can be influential constructs in the teaching and learning of school mathematics. Taking the definition of culture broadly, it is reasonable to expect teachers (of mathematics) to experience differences of values at one time or other in their respective professional lives. It is also reasonable to argue that such experiences are especially felt by teachers in transition between school systems, school locations, as well as student gender types, and perhaps, more so for immigrant teachers. In this context, the

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chapter will now examine current academic knowledge on the process of teacher socialisation as constituting another approach with which to frame the current study.

Professional socialisation is the "process by which neophytes come to acquire, in patterned and selective fashion, the beliefs, attitudes, values, skills, knowledge, and ways of life established in the professional culture" (Su, 1990, cited in Su et al., 1997; see also Horowitz, 1986). Teacher socialisation is the process through which a teacher becomes a participating member of the teaching profession (Danziger, 1971). It is a process which is concerned with teachers "learning how to teach, understanding the roles and responsibilities of teachers, and the values, attitudes, concerns of schools, and the teaching profession" (Lacey, 1977, cited in Asam & Cooper, 2000, p. 3). Court (1999) uses the term 'alignment' to refer to essentially the same concept in her research with immigrant teachers in Israeli schools:

> There is a relationship between alignment of a teacher's values with educational and institutional values and successful change and adaptation. Alignment does not have to mean agreement, it means understanding one's own values, understanding the norms, and values embodied in an educational Innovation [sic], and making peace between them. (p. 33)

In this context, immigrant teachers' attempts at reducing/eliminating dissonance caused by cultural value differences constitute part of these teachers' own socialisation process in Australian schools.

This process is by no means straightforward or common across different teachers. Hofstede (1997) researched into the experiences of individuals on temporary job placements in foreign countries, which led him to conceptualise socialisation in the form of an 'acculturation curve', consisting of different phases and different possibilities within particular phases:

> phase 1 is a (usually short) period of *euphoria*: the honeymoon, the excitement of travelling and of seeing new lands. Phase 2 is the period of *culture shock* when real life starts in the new environment .... Phase 3, *acculturation*, sets in when the visitor has slowly learned to function under the new conditions, has adopted some of the local values, finds increased self-confidence and becomes integrated into a new social network. Phase 4 is the *stable state* of mind eventually reached. It may remain negative compared to home (4a), for example if the visitor continues feeling alien and discriminated against. It may be just as good as before (4b), in which case the visitor can be considered to be biculturally adapted, or it may even be better (4c). In the last case the visitor has 'gone native' — she or he has become more Roman than the Romans. (pp. 209-210)

If teachers' professional socialisation is seen to be a process, then all these phases may be perceived to constitute the socialisation experience. It is worthy that phase 1 has been

seen to be relatively short in duration, and value differences are expected to be experienced in all subsequent phases, that is, including phase 4. The preceding discussion on values has argued for viewing value change as ongoing and evolutionary; attainment of the 'stable state of mind' (phase 4) may indicate an immigrant teacher's capability and confidence in negotiating perceived value differences, possibly using approaches listed in Table 2.3, but living this phase out does not preclude future occurrence of value differences. In other words, the term 'stable' as used to describe phase 4 may be seen to represent something relative rather than absolute.

2.3.1 Factors affecting Teacher Socialisation Experiences

Certainly, the teacher socialisation process is best understood in a broad context of culture, history, politics, society and institution, and is mediated by such factors as race, social class and gender (Zeichner & Gore, 1990). Zeichner and Gore (1990) identified three major viewpoints in their review of literature relating to pre-training influences on teacher socialisation. First, there is the evolutionary theory from Stephens (1967) who emphasised the roles of 'primitive spontaneous pedagogical tendencies' (such as in children learning naturally to be teachers) and of 'spontaneous manipulative tendencies' (such as in children's playful tendencies which have no immediate purpose/use, but which prove useful later in life). Secondly, there is the psychoanalytic viewpoint from Feiman-Nemser (1983), who held the view that the quality of relationships a teacher had with significant others when she was a child would affect the course of her socialisation into the profession. Thirdly, there was also Lortie's (1975) notion of the 'apprenticeship of observation' experienced by a teacher when she was a student, and which provided this teacher with both positive and/or negative role models to emulate and/or avoid respectively.

Zeichner and Gore (1990) also identified other viewpoints regarding the socialisation baggage teachers bring with them to teacher education courses and to their respective classrooms. These include teacher knowledge and dispositions towards subject matter and towards its teaching, dispositions towards teacher training itself, as well as types of teacher commitment to teaching.

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Pre-service training courses also impact on teachers' practice (Astin, 1977; Feiman-Nemser & Buchmann, 1986), although Zeichner and Gore (1990) expressed reservations of the significance of its direct influences. Their literature survey presented examples of research arguments which stressed the power of the hidden curriculum within teacher education courses in affecting knowledge, skills and dispositions, although both Kenneth Zeichner and Jennifer Gore noted the very little supporting empirical evidence. Thus, it was interesting to note Asam and Cooper's (2000) report more recently that native Hawaiian pre-service teachers' socialisation experiences were very much influenced by their ongoing teacher training course. The study offered an explanation for this observed difference: the pre-service teachers in the study were ethnic minority trainees in a 'western' teacher training institution. In other words, in the context of this study, pre-service training courses may actually exert an appreciable influence on immigrant trainees in ways which may not be as significant to their 'local' peers.

Pollard (1982) identified three levels of workplace-based influences in his conceptual model, namely, interactive, institutional, and cultural. Support to immigrant teachers' attempts at negotiating cultural value conflicts inherent in their professional practices in Australia at the workplace level is especially important, particularly if the teacher involved tries to do so by cultivating a modified socio-cultural environment within the classroom. Within logical, reasonable and pedagogically desirable parameters underlying such 'new' professional teaching environments, the degree to which an immigrant teacher's effort is successful would be expected to depend a great deal on the willingness of students, parents, colleagues, supervisors and the community-at-large to embrace change.

At the interactive level which relates to the activities and interactions within the classroom, the ecology of the classroom presents the teacher with many factors which are relevant to teacher socialisation processes (Copeland, 1980; Denscombe, 1982), both material (e.g. teacher-student ratios; quality, type, variety and availability of resources) and by nature of the classroom setting. For the latter, Doyle (1986) proposed that six classroom features are crucial: multidimensionality, simultaneity, immediacy, unpredictability, publicness, and history. Particularly, "the significant role of pupils on the socialization of teachers is supported both on logical grounds and by empirical evidence

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.... However, there is currently very little understanding of how the specific characteristics of teachers and pupils mediate the processes of teacher socialization"

(Zeichner & Gore, 1990, p. 339), although Lewis-Shaw (2001) provided some insights:

> both teacher and students continuously engage in a process of determining which values are held in common and the extent to which value difference exists. In fact, negotiation proceeds continuously at the affective level, whether teacher and learner are conscious of it or not. They are both constantly checking, testing and calibrating, for example, through reflected appraisals, their respective affective states and its likely influence on what is taking place. Through a tacit form of affective negotiation participants proceed, often in a reiterative manner over time, through the process of framing and reframing constructs of meaning as they deal both individually and socially with difference, uncertainty and the unknown. (p. 189)

Factors underlying the way in which a teacher socialises into the profession may also be related to the nature of schools as workplaces, specifically the respective institutional bias (Pollard, 1982; Zeichner & Gore, 1990). These factors may be organisational (such as reflected in the school's organisational chart) or interpersonal (as in the influence of colleagues, supervisors/performance appraisers, and parents) in nature. For example, "staffroom colleagues act as major reference groups 'a group whose outlook is used by an actor as a frame of reference in the organisation of his perceptual field' (Shibutani, 1955)" (Pollard, 1982, p. 25). In the words of Denscombe (1980),

> the strategies employed by teachers arise in the context of a school organisation which provides the prevailing circumstances taken into account by teachers in their routine activity. The school organisation provides dilemmas and imperatives, possibilities and opportunities, and it is these which explain the existence of particular strategies in the classroom. (p. 290)

Of course, "teachers do not necessarily passively conform to these pressures, but they must take them into account in some way as they go about their work" (Zeichner & Gore, 1990, p. 340).

The evolving character of a teacher in her profession is also shaped by factors at the societal level. These may include the level of socio-politico support (e.g. financial, infrastructural) for teacher ongoing professional development program, level of over-/under-representation by one gender or particular age-groups, and the nature of the collective political voice of teachers. The quality of a teacher's socialisation is also expected to be affected at this level by the social status accorded to teachers, a measure of which may be teacher remuneration.

Another factor affecting socialisation experiences at the cultural level may be the teacher's ethnocentrism. The term was first coined by William Sumner (1906) to refer to a "view of things in which one's own group is the center of everything, and all others are scaled and rated with reference to it" (p. 13). As a result, "people readily though not inevitably develop strong loyalties to their own ethnic group and discriminate against outsiders" (Cashdan, 2001, p. 760). Ethnocentrism needs not be displayed only by immigrant teachers; for example, Eckermann (1994) reported on the Anglo-oriented principles of teachers in multicultural school settings, and she noted that

> it is ... difficult not to evaluate, to judge difference, the unknown, from the perspective of the familiar, or what is thought to be known and understood. In the process it is easy to stereotype, to apply generalisations to people and situations on the basis of very little real but a great deal of assumed evidence. These patterns are prevalent among all people, all cultures, throughout the world and are part of a universal human characteristic — ethnocentrism — a belief that one's own group is best and that all others, if not exactly inferior, are at least somewhat strange and dubious in their behaviours, traditions and beliefs. (p. 225)

Current literature appears to indicate, however, that research with immigrant or ethnic minority teachers have mostly been conducted at the institutional and cultural level as far as workplace factors are concerned. Bascia (1996), Madsen and Mabokela (2000), and Santoro (2000) examined the relationship between these teachers and organisational culture (and in Santoro's case, between teachers and students as well). Chinn and Wong (1992), and Su et al. (1997) based their discussions on teacher training programs. None of these, however, examined immigrant or ethnic minority teachers at the interactive level, i.e. in the classroom, taking into account the interaction between them and their students. In fact, none of the studies mentioned above was based on data grounded in classroom interactions and lesson observations. Recognising that teachers possess considerable autonomy and authority within the confines of a classroom, it is equally important to investigate how cultural value differences and conflicts are negotiated by the teacher in her interaction with students. The professional capability of the immigrant teacher is no less (if not more) affected by this teacher's handling of value conflicts during lesson delivery and class management than the impact of organisational and/or societal pressures.

Certainly, the earlier discussion making the point for considering teachers' pre-training life experiences and their developments as student teachers as factors influencing teacher socialisation also suggests the need for this current research study. That is, there is

a need to examine immigrant teachers' professional socialisation because they had grown up, attended school, trained as teachers, and practised overseas. These experiences were expected to guide the development of the teachers' value systems. Practising in Australia, then, is likely to lead each of these teachers to live through the 'acculturation curve' that was introduced in Section 2.3, and in ways which would be more intense than any 'local' teacher in transition would ever go through.

2.3.2   Dealing with Differences and Conflicts

All the above factors partly determine the extent to which a teacher's socialisation experience is a smooth one. Value differences that are perceived would naturally need to be interpreted and negotiated by the individual. One perspective relating to dealing with such perceived differences has been Jean Piaget's view that the human mental structures actively seek to achieve equilibrium between an individual and her surrounding (see, for example, Duncan, 1995). Schlöglmann (2001) related beliefs to affect logic, in terms of the stability of the affective component of the human psyche, and talked about "stabilised emotional schemata" (Schlöglmann, 2001, p. 8) which would be indicative of an individual's success in addressing the changes confronting the schemata.

Of interest in the context of this study is, what happens when this equilibrium between psyche and environment is threatened or disrupted? How might an immigrant teacher respond, for example, when she realises in her first days in the mathematics classroom that Year 12 students in Victoria are allowed to bring mathematics notes into the examination hall? Festinger's (1957) 'theory of cognitive dissonance' is perhaps a good starting point with which to explore possible answers. It should first be noted that while Festinger (1957) used the phrase 'cognitive dissonance', 'cognition' was used in a broad sense, referring to "any knowledge, opinion, or belief about the environment, about oneself, or about one's behavior" (p. 3). That is, this knowledge, opinion or belief might also include values.

The central ideas encapsulated in the 'theory of cognitive dissonance' are as follows:
— inconsistent knowledge, opinion or belief about one's self, behaviour and environment leads to psychological discomfort,

— there exists an internal drive to reduce or eliminate these cognitive dissonance through a variety of ways.

The mathematics classroom teaching experience of immigrant teachers provides fertile ground for affective-cognitive dissonances to occur. Indeed, the two common sources of dissonance identified by Festinger (1957) would apply to the professional experience of immigrant teachers as well. The first relates to new events/information, and, for immigrant teachers practising in a new culture, it is reasonable to assume that these new inputs would be understood against the teachers' own pre-training, teacher-education and in-service experiences. The second common source of cognitive dissonance arises from an individual's need to formulate opinions/decisions. This is likely to be especially relevant to immigrant teachers who are trying to make sense of the new culture, as well as of their respective new workplace within the new culture. In particular, "dissonance could arise because of cultural mores …. In some other culture these two cognitions might not be dissonant at all" (Festinger, 1957, p. 14). This is precisely how cultural value conflicts in the mathematics classroom in this study are regarded as one form of 'cognitive dissonance'. That these teachers may not be in the position, or may not have the necessary 'tools', to respond in ways which reduce or eliminate these value differences would simply mean that the dissonance concerned may persist (Festinger, 1957).

As we have seen earlier, the negotiation of these dissonances can be affected by the teachers' pre-training experience, teacher-education course, and workplace experience. According to Festinger (1957), such dissonance may be reduced or eliminated in one of the following ways: (1) changing a behavioural or environmental factor causing the dissonance, (2) adding new elements to reduce the proportion of dissonant elements to consonant elements, or which 'reconciles' the dissonant elements, or which detaches the person experiencing the dissonance psychologically away from the action. These strategies highlight possibilities for direct and indirect approaches to negotiating conflicting values that underlie the factors. The notions of competing, overriding and second-hand values (as discussed in Section 2.2.3) can also fit comfortably into discussions of how the conflicting factors may be changed or of how new factors may be introduced to resolve the dissonance.

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A model for negotiating dissonance that reflects the strategies proposed by Festinger (1957), but more importantly, which applies to the mathematics educational context, was proposed by Bishop (1994). Drawing on related research across mathematics education, Alan Bishop conceptualised five different possible teacher approaches to cultural conflicts, that is, culture-blindness (traditional view), assimilation, accommodation, amalgamation, and appropriation (see Table 2.2). These produce a framework with which possible ways in which education policy makers, teacher educators, and teachers respond to culture conflicts in the mathematics classroom may be explored.

Table 2.2

Teacher/institutional Approaches to Culture Conflicts in Mathematics Education

Approaches to culture conflict	Assumption	Curriculum	Teaching	Language
Culture-blind Traditional view	No culture conflict	Traditional Canonical	No particular modification	Official
Assimilation	Child's culture should be useful as examples	Some child's cultural contexts included	Caring approach perhaps with some pupils in groups	Official, plus relevant contrasts and remediation for second language learners
Accommodation	Child's culture should influence education	Curriculum restructured due to child's culture	Teaching style modified as preferred by children	Child's home language accepted in class, plus official language support
Amalgamation	Culture's adults should share significantly in education	Curriculum jointly organised by teachers and community	Shared or team teaching	Bi-lingual, bi-cultural teaching
Appropriation	Culture's community should take over education	Curriculum organised wholly by community	Teaching entirely by community's adults	Teaching in home community's preferred language

Note. From "Cultural Conflicts in Mathematics Education: Developing a Research Agenda", by Alan J. Bishop, 1994, *For the Learning of Mathematics, 14* (2), p. 17. Copyright 1994 by FLM Publishing Association. Adapted with permission of the author.

These approaches reflect the perspectives of policy makers, and/or of 'local' teachers who may have a number of 'ethnic' pupils in their classes. The current study, however, is concerned with immigrant teachers practising in classes of largely 'local' pupils. These situations are different in several important ways, thus impinging on how the table may be

used to interpret observations to be made in the current study. Most — if not all — immigrant teachers are expected to confront value differences personally, without direct support from colleagues or the wider school community (Santoro et al., 2001), and (immigrant) teachers do not enjoy as much authority as administrators anyway, so it may not be as meaningful to discuss emergent forms of curriculum corresponding to each possible teacher approach. The teacher's range of languages of instruction and interaction is also an irrelevant construct in the current study when the 'ethnic' individual's language level being catered for is that of the teacher herself.

Table 2.3

Approaches by Immigrant Teachers to Value Differences in Mathematics Education

Approaches to value difference/conflict	Assumption	Teaching
Culture-blind Traditional view	There is no culture conflict	I teach mathematics in the same way I did in my home culture.
Assimilation	The Australian culture should influence the surface characteristics of my mathematics teaching.	I include the Australian cultural contexts in my teaching, such as in examples and problem sums.
Accommodation	The Australian culture should be espoused.	Planning and classroom decisions are affected by the Australian culture.
Amalgamation	The essence of my home culture and the Australian culture should guide mathematics teaching.	My teaching reflects a synthesis of teaching styles from my home culture and from Australia.
Appropriation	My home culture and the Australian culture should interact to inform my mathematics teaching.	My mathematics teaching style consistently reflects an adaptation of my home culture to local norms and practices.

It is thus desirable to adapt Table 2.2 in ways which render the modified list a more meaningful interpretation tool for understanding immigrant teachers' experience with culturally-based differences. This modified list is presented here as Table 2.3. The five conceptualised approaches to perceived value differences also reflect an increasingly greater acknowledgement of the Australian mathematics education traditions in an immigrant teacher's pedagogical repertoire in Victoria, and an increasingly complex interaction between the two teaching cultures. Each of these approaches may be understood against the set of assumptions in the middle column of Table 2.3. The next column exemplifies how the approaches may be articulated in practice.

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At one end of the list is the culture-blind approach in which the teacher assumes that mathematics and/or mathematics education is or should be culture-free. Cultural differences relating to mathematics and mathematics pedagogy is probably a meaningless concept to the teacher. Any perception to that effect is likely really the result of cultural differences in other aspects of cultural life experiences. Thus, school mathematics should be (and will be) taught in ways which had proven effective in the immigrant teachers' practice in the home culture.

The use of the labels 'assimilation' and 'accommodation' for the next two approaches reflects differing degrees of internalisation of the Australian mathematics education traditions and the cultural assumptions upon which these are based, in much the same way that Jean Piaget used them to refer to the mechanisms with which learners' schema respond to environmental stimuli. With the 'assimilation' approach, the teacher remains committed to the home culture's pedagogical practices and the underlying values. Adaptation is likely to be articulated through the structuring of contexts of teacher explanations, examples, problem sums, etc in Australian terms; the teacher's pedagogical style remains largely unchanged. Indeed, the teacher's values relating to mathematics and mathematics education may remain the same regardless of the community of professional practice she finds herself in. As an example, a teacher who includes 'extended questions' in her worksheets may be seen to be valuing *process*, but she may really just be assimilating the school's established routines, while she continues to portray her valuing of *product* by awarding marks based only on the final answers given by the students. In a sense, then, this assimilation approach is analogous to the relative stability (in Piagetian theory) of an individual's cognitive schema when re-achieving equilibration through assimilation.

With the 'accommodation' approach, however, the teacher is totally receptive to the Australian (pedagogical) culture, such that decisions and actions reflect this acceptance and internalisation of relevant aspects of the host culture. The organisation of the teacher's schema relating to mathematics teaching and learning are expected to be altered as a result of accommodating to the value difference situation.

Representing a more interacting and dynamic relationship between the teaching styles of a teacher's home and host cultures would be the 'amalgamation' and 'appropriation'

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approaches. A teacher adopting the 'amalgamation' approach will likely demonstrate the best and most appropriate features of the home and host cultures' teaching traditions being brought together to optimise teaching and learning. However, these pedagogical features remain independent of one another, and as such the cultural traditions upon which they are based are easily identifiable. A visit to the classroom of a teacher adopting the 'amalgamation' approach is likely to reveal aspects of teacher practice which may be attributed to the home culture, as well as other aspects that reflect Australian customs and beliefs.

On the other hand, with the 'appropriation' approach, the immigrant teacher is likely to be fully aware of the socio-cultural context of mathematics and mathematics pedagogy, perceive value differences in this context, recognises the strengths and weaknesses inherent in the mathematics education traditions in both the home culture and in Victoria, and appropriate a teaching style which is personally customised to the mathematics education system in the Victoria classroom. The immigrant teacher probably regards this teaching style as being optimal for students' learning and understanding of mathematics concepts and skills. An observation of the practice of such an immigrant teacher may reveal novel teaching approaches that have been adapted to the local context. Unlike the amalgamation approach, it is relatively harder to define teacher practice of an appropriation approach in terms of distinct components of features representative of the home or Victorian cultures.

This research study will explore the extent to which these five approaches to negotiation of value differences is useful in integrating immigrant teachers' professional socialisation in the Australian mathematics classroom. The conceptualisation of these various approaches had been stimulated by Bishop's (1994) more general framework of cultural differences in mathematics education, and this range of five approaches outlined above has not yet been validated through evidence-based research in any systematic manner. Some prior research findings related to teacher socialisation, however, have been observed to indicate positive correspondence between teacher responses and the five approaches of culture-blindness, assimilation, accommodation, amalgamation and appropriation, and these will be discussed below.

The first three approaches, i.e. culture-blind, assimilation and accommodation, are rather similar to the approaches reported by Court (1999) in her interviews with Russian immigrant teachers in Israel. There, three levels of adaptation were presented. These adaptation approaches were labelled in order from shallowest to deepest, and Court (1999) referred to "a relationship between alignment of a teacher's values with educational and institutional values and successful change and adaptation" (p. 33).

If these first three approaches describe teachers' adaptation to the profession in the context of value differences, then the next two approaches may be perceived to refer to greater degrees of personal reflection and professional integration into the educational system of the host culture. Both the amalgamation and appropriation approaches reflect the teacher's desire to take advantage of the pedagogical strengths of the educational systems of the home and host cultures to optimise the teaching and learning of mathematics in schools. It may perhaps be said that a teacher operating in either of the two approaches has gone beyond adapting to the new educational system, and is proactively integrating the relevant pedagogies into her teaching repertoire.

For example, the appropriation approach was demonstrated in a few instances of negotiating perceived value differences by Fast (2000) when he recounted his teaching experience in a foreign country:

> In my experiences as a teacher in Zimbabwe, I discovered the importance of adapting not only my teaching strategies but also my thoughts and actions to the culture. This allowed me to look beyond the obvious by adopting a new perspective. (p. 100)

Equally significantly is the observation that Fast had adopted multiple negotiation approaches to negotiate the differences in values he had perceived. The different ways in which he had responded to the cases he reported may be associated with what are called 'accommodation' and 'appropriation' in Table 2.3. It appears, then, that successful negotiation of perceived value differences in a new culture needs not be associated with the choice of any particular negotiation approach only.

Chew and Lim's (1995) study of the conflict-handling modes of ethnic Chinese business managers had also made the same observation. While the participants in this study expressed a preference for particular conflict-handling approaches, their

questionnaire responses revealed that different approaches have actually been utilised to resolve the different conflicts. As was reported,

> The Chinese business managers' form of conflict management can be likened to the changing colours of the chameleon ....several forms were utilized on different occasions but these styles also reflected an explanation of thinking. (Chew & Lim, 1995, p. 155)

Again, as for Court (1999), values held by the participants were found to relate to the conflict-handling mode preferences. For example, respondents who emphasised *collectivism* were more likely to adopt the compromising mode of conflict management.

While the strategies offered by Festinger (1957) (discussed a few paragraphs above) demonstrate possible actions that might be taken by individuals to respond to dissonance, the model outlined in Table 2.3 provides a list of approaches to negotiate similar dissonance. In this sense, the model of teacher responsive approaches is more general and it provides for the possibility of different actions. Also, the model also differs from Festinger's strategies in that the amalgamation and appropriation approaches demonstrate possibilities for aspects of cultures to interact together in response to the perceived differences. That is, rather than being enculturation experiences, (immigrant teachers') professional socialisation may be seen to be acculturation exercises (see Bishop, 2002). Transition is an acculturation process (Bishop, 2002), and not only may teachers of mathematics be seen to be prime agents of acculturation in the classroom (Bishop, 2002), but they too may be considered to be subjects of professional acculturation.

2.3.3 The Experiences of Immigrant, Expatriate and Ethnic Minority Teachers

The professional socialisation experiences of immigrant teachers may be similar to that of expatriate teachers, for both groups practise across geopolitical cultures. They are also expected to be not much different from ethnic minority teachers as they negotiate their practice in the context of a dominant culture in the Australian society and workplace. These assumptions are made here so as to widen the scope for relevant literature references to the socialisation experiences of immigrant teachers; despite evidence of substantial demographic movements across borders, there has been very little educational research into the lives of immigrant teachers.

Even then, educational research studies on ethnic minority teachers have been relatively rare (Bascia, 1996). Recent studies on this group of educational professionals

also tend to have been conducted in America (e.g. Asam & Cooper, 2000; Bascia, 1996; Chinn & Wong, 1992; Su et al., 1997; Zimpher & Ashburn, 1992), UK (e.g. Rakhit, 1998) and Israel (e.g. Court, 1999; Horowitz, 1986). "Much less research has considered the nature of Australia's increasingly multicultural teaching profession or the experiences of ethnically different teachers in schools" (Kamler, Reid, & Santoro, 1999, p. 55), even though Australia is a multicultural commonwealth and has put in place an ongoing immigration program. In fact, "educational research in Australia ... has largely focussed on the experiences of students (rather than teachers) of ethnic difference" (Kamler, Santoro, & Reid, 1998, pp. 1-2). While this lack of academic research attention could be taken to mean that the professional socialisations and transitions of immigrant teachers must be generally smooth, Santoro's (1997) study of the experiences of Chinese born and educated student teachers in Australia revealed the difficulties and challenges they faced. Soviet and American immigrant teachers in their first two years of teaching in Israel have also demonstrated significantly different student control ideologies and general educational philosophies (Horowitz, 1986); surely, then, some if not all of these immigrant teachers experienced value conflicts in the Israeli classrooms. Such a phenomenon can also be inferred from Hofstede's (1997) statement that:

> migrant families in their new environment experience standard dilemmas. At work, in shops and public offices, and usually also at school, migrants interact with locals and are re-programmed to local values. At home they try to maintain the values and relationship patterns from their country of origin. They are marginal people between two worlds and they alternate daily between one and the other. (p. 222)

A value conflict at the interactive level and potentially experienced by immigrant teachers was reflected in the interviews conducted by Su et al. (1997) with Asian American student teachers. Many of these student teachers had come from countries where students (and the society at large) accorded much respect to teachers, and they found that similar level of respect was absent in the United States. A similar difference in cultural perception of the teaching profession between Asian countries and Australia is also expected to exist, given that both the United States and Australia are traditionally western cultures. Also, there may be a greater chance of immigrant teachers perceiving this difference because ethnic minority teachers may possibly be more socialised already into the ways of life in the host country, having possibly grown up and/or been educated there. Such differences in the social recognition and standing of teachers affected the

classroom environment in which the immigrant teacher operates, as well as the nature of relationship between the teacher and her students, their parents, colleagues and supervisors. There were also implications for the applicability and effectiveness of different pedagogical strategies across cultures, as the success of some of these strategies (e.g. whole-class teaching) could be achieved insofar that the associated values embraced by the home culture are also affirmed in the host culture.

Another area of value conflict is related to student discipline. In a study conducted by Madsen and Mabokela (2000), African American teachers reported that "the power and control of traditional management practices used by the European American teachers resulted in African American children being more aggressive" (p. 869), and that they believed that their own flexible management style would have been more beneficial. Moreover, these teachers' socialisation experience was further hampered by criticism from their European American peers for adopting different disciplining strategies for different students.

For an ethnic minority teacher of mathematics, dissonance may arise from her perception of the abilities or motivations of students in the host culture. As an example, the rationale behind the relatively lesser number of topics in the secondary mathematics curriculum in Australia may not be immediately understood by an immigrant teacher who had grown up in a culture where relatively more topics were taught. Instead, she might interpret this in terms of differences in student capability or motivation to learn. Psychological discomfort, that is, dissonance, may be experienced as a result of perceiving a difference in the valuing of, say, student *motivation*.

Teacher socialisation difficulties had also been reported at the institutional level. Organisational cultural insensitivity had been related to teacher experience of "the pervasive power of racial categories in erasing individual variability and complexity" (Madsen & Mabokela, 2000, pp. 858-859). Teacher perception of racism was reported by David (1993), and by Santoro et al. (2001). The modeling and advocacy roles taken up by some ethnic minority teachers had also led to the occurrence of several conflict situations in their respective workplaces. For some, the relationship between ethnic minority teachers and minority students was reported to signal ramifications for professional status and organisational access (Bascia, 1996). Ethnic minority teachers had also perceived

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exclusion from mainstream professional and social formal and informal interactions, conflicts between personal values and beliefs of what was acceptable in the school, which sometimes led to teacher engagement with covert subversive actions in the classroom (Bascia, 1996).

A recurring outcome reported in most research with minority teachers is the feeling of professional, social, and cultural alienation and isolation (see, for examples, Bascia, 1996; Court, 1999; Kamler et al., 1998; Madsen & Mabokela, 2000; Meacham, 2000; Overberg, 1976). In Australia, in-depth research with eight overseas–educated, non-native English-speaking teachers of Languages Other Than English (LOTE) revealed a general sense amongst these teachers of professional and cultural isolation in the education system, especially amongst those teaching in small or isolated communities (Santoro et al., 2001).

In addition, this failure by an immigrant, expatriate or ethnic minority teacher to confront and resolve value differences may lead to this teacher 'staying within herself' professionally, or at most restricting her interaction to only peers of the same ethnicity. Unfortunately, this can sometimes be interpreted by peers from the dominant culture as a preference by immigrant colleagues to segregate and exclude themselves from the mainstream, instead of it being recognised as being one way through which these teachers can derive some form of psychological and/or emotional support. As Meacham (2000) observed, "this interest in forming relationships [with peers from one's home culture] suggests that there is an importance to being able to relate to people who have experienced a [similar] kind of passage" (p. 594).

Of course, not all ethnic minority teachers subject themselves to be isolated professionally or culturally. Some also embrace the dominant, host culture. For example, one of the teacher participants in Kamler et al's (1997) study felt that overseas-born teachers should be Australian enough, "to 'be' more like the majority: to be able to take a joke, to forgo old values for new" (p. 21), a response similar to the accommodation approach in the model of teacher approaches to value differences (Table 2.3).

In his study with two African American teachers, Meacham (2000) found that the teachers responded to the phenomena of cultural denial and cultural limbo by devising "strategies that enabled them to maintain their commitment to entering the teaching

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profession and their commitment to the cultural well-being of African American students" (Meacham, 2000, p. 589). The teachers' two primary 'survival strategies' were the cultivation of a 'language of critique' and the refinement of their respective personal values systems. A language of critique allowed the teachers to adopt a critical perspective of the situation in the context of a validation of the role of African American English. The cultivation of new values, on the other hand, enabled the teachers to negotiate value conflicts, thereby maintaining the teachers' professional well-being. What was perhaps at the heart of the problem was the range of value conflicts relating to the use of different types of 'English', and both survival strategies exemplified the teachers' successful negotiation of these conflicts by re-orienting their values, such as values about African American English and about the notion of success in a mainstream culture. Essentially, these survival strategies effectively prevented the teachers from experiencing professional isolation. These teacher participants were functioning with a belief that their teaching should validate the relevance of their home culture. They regained their confidence and strength in the security of their cultural identity. Armed with a critical perspective, these teachers fine-tuned their respective value systems. Essentially, their strategy reflected the appropriation approach (see Table 2.3), one which made use of home cultural values to enhance the host culture's teaching orientation.

Bascia (1996) argued for corresponding strategies to be put in place at the administrative and organisational levels to further support the professional socialisation of immigrant, expatriate and ethnic minority teachers. Of course, the extent to which this can actually be operationalised in any effective way differs among different societies and cultures, taking into account political and societal interests and demands. Yet, institutions and the society-at-large do play an active role in facilitating teachers' negotiation of cultural value differences. In fact, "the important factor in the attempt to eliminate the dissonance ... is the total amount of resistance to change [in which the institution and the society play a part]; the source of the resistance is immaterial" (Festinger, 1957, pp. 27-28).

We have seen in this section how little attention appears to have been directed to understanding and subsequently optimising the professional socialisation experience of immigrant, expatriate and ethnic minority teachers. In particular, the level of empirical

research with immigrant teachers of mathematics has been nearly non-existent, at a time when Victoria will potentially see more of these teachers in its schools as it faces a crucial shortage of (secondary) teachers of mathematics. That factors related to immigrant teachers' personal, academic and professional experiences in their respective home cultures have been found to significantly inform the quality of these teachers' socialisation process in the host culture further points to the need for researching their professional lives in transition. The extent to which the conceptualised model of teacher approaches to perceived value differences during this acculturation exercise is useful in helping us develop a representative range of approaches will be explored in this study.

2.4 Research Questions

Chap. 1 outlined the rationale for the current study and discussed its significance not just for immigrant teachers of mathematics in Australia, but also for all teachers, students, schools and the society in general. This chapter has presented current research knowledge pertaining to the socio-cultural aspects of mathematical knowledge and mathematics education, to values related to mathematics and mathematics pedagogy, as well as to teacher professional socialisation.

The fact that both mathematical knowledge and mathematics education are socio-cultural in nature, and the fact that teacher socialisation influences have been traced to teachers' pre-training days, emphasise the importance of greater understanding of value differences in the multicultural mathematics classroom. In this light, the first research question is: **What is the nature of value differences perceived by immigrant teachers in the Australian secondary mathematics classroom? In view of the hitherto virtual absence of value conflict research in mathematics teaching/learning, to what extent are the value differences perceived directly related to mathematics and its pedagogy?**

Existing research literature also documents teachers' successful negotiation with value differences. The importance of empowering more (immigrant) teachers to respond to perceived differences in positive ways, supported at the same time by relevant strategies at both administrative and organisational levels, has been emphasised. Table 2.3 represents a theoretical conception of a range of possible immigrant teacher responsive

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strategies to value differences encountered in the mathematics classroom in Australia. The second research question is concerned with immigrant teachers' ways of coping with — and negotiating about — perceived value differences in their professional practice. In the current study, documented teacher approaches in their respective attempts to negotiate such differences — and the strategies adopted — are expected to extend the scope of the conceptualised model (Table 2.3) in ways which reflect the variety of possibilities and creativity of individual teachers concerned. Thus, the second research question will be: **What are the approaches adopted by immigrant teachers to cope with and/or negotiate perceived value differences as part of their own professional socialisation process? What are the underlying assumptions, and how might these approaches be displayed in observable ways? To what extent have these approaches been reflected in the conceptualised model of teacher approaches discussed earlier (see Table 2.3)?**

The immigrant teachers participating in this study would have come from several different cultures outside Australia. The socio-cultural context of mathematics and of mathematics education (as we discussed in Section 2.1) would thus contribute further to the teachers' diverse range of personal cultural fund. As we saw in Section 2.3, these pre-training and pre-service experiences are significant factors which impact on the teachers' socialisation experiences. The discussion in Section 2.2 also suggests that in the negotiation of any one value difference situation, several relevant values held by any individual will be brought to bear. In other words, similar value difference situations perceived by different individuals can potentially be negotiated with different approaches. Of interest in the third research question, then, is: **What are the operating contextual factors that interact to guide teacher choice of responsive approaches? In particular, what are the roles played by competing, overriding and second-hand values?**

This chapter has enabled a theoretical framework to be set up within which this study may be defined. This framework has been grounded in three directions within existing academic knowledge, namely, the socio-cultural context of mathematics and mathematics education, the function of values in mathematics education, as well as teacher professional socialisation (particularly, of immigrant, expatriate and ethnic minority teachers). Additionally, a model of teacher approaches to value differences in the mathematics classroom was modified from a similar model proposed by Bishop (1994). It

is expected that this model will facilitate understanding of the immigrant teachers' experience in the Australian classroom; at the same time, it is also envisaged that the data will in turn fine-tune the model to render it a useful professional development tool for teachers in transition. This data, however, needs to be meaningfully collected, documented and analysed in order that valid and reliable information may be constructed. The next chapter will discuss how this process may be carried out in the course of conducting this study.

CHAPTER 3

RESEARCH METHODOLOGY

Chapter 1 had identified the research problem in the context of Victoria's socio-cultural and educational scenes, and outlined the significance of conducting this current study. Chapter 2 framed the study within the contexts of the socio-cultural context of mathematics and mathematics education, values and its role in mathematics education, as well as teacher socialisation, leading to the formulation of the research questions which this study will address.

This chapter will present the research methodology that will be used in this study. Its formulation will be guided by current knowledge in social and education research design. It will incorporate proven strengths, and avoid reported weaknesses in related studies. Every research endeavor is uniquely different in one way or another, and this one is no different. Thus, there will also be aspects in the methodology of this study which feature personal design, adaptations and modifications arising from relevant practical considerations.

3.1 Research Strategy and Processes

A survey of the research designs in related studies (Brown, 2001; Chin & Lin, 1999a, 1999b; Frid, 1995; Gondoseputro, 1999; Ikonomou, Kaldrimidou, Sakonidis, & Tzekaki, 1999; Kaleva, 1998; L:u, 1998, 1999; Raymond, 1997; Seah et al., 2001) suggested that the intended study will benefit most from a qualitative research approach. After all, as is evident from the research questions, the intended study does not seek to confirm any hypothesis. Rather, the al involves understanding, describing, discovering, and hypothesis/theory generating, all characteristic of qualitative research (Hoshmand, 1989; Merriam, 1988; Neuman, 1997). Investigating how immigrant secondary mathematics teachers make sense of and negotiate perceived content and pedagogical value differences acknowledges another characteristic of qualitative research, that is, there is no single, objective reality; rather, the world is a function of one's interpretation and perception (Kvale, 1996; Merriam, 1988; Miles & Huberman, 1994). The intended study is also concerned with process and sequence, rather than with outcomes which are characteristic of quantitative research studies (Neuman, 1997).

Nevertheless, school responses to survey slips and part of the questionnaire data will need to be presented via descriptive statistics, not so much as to provide answers to the research questions of this study, but to provide a generalised context for the purpose of qualitative data interpretation and analysis.

That the focus of this study is based on a cognitive-affective construct (i.e. values) also helps to lean the research towards a qualitative methodology. Guba and Lincoln (1981) noted that

> in situations where motives, attitudes, beliefs, and values direct much, if not most of human activity, the most sophisticated instrumentation we possess is still the careful observer --- the human being who can watch, see, listen ... question, probe, and finally analyze and organize his direct experience. (p. 213)

As Chew and Lim (1995) noted after their quantitative study of value conflicts using the Thomas-Kilmann Conflict Mode Instrument,

> as a self-report instrument it can measure only reported preferences and not actual conflict behaviour. It follows that more qualitative research and content interviews have to be conducted to map out the actual conflict behaviour of Chinese business managers if more cross-cultural learning in conflict behaviour is to be unravelled. (p. 156)

Richardson's (1996) survey of research literature on the cognitive-affective constructs of attitudes and beliefs reported a shift of research methodology from large-scale, paper-and-pencil, and/or multiple-choice-question tests to interviews, observations, journals, and/or portfolios as means of understanding how teachers thought and constructed their own worlds and the world around them, so as to better facilitate teacher change. The more recently-conducted studies (e.g. Brown, 2001; Chin & Lin, 1999a, 1999b; Gondoseputro, 1999; Ikonomou et al., 1999; Kaleva, 1998; Leu & Wu, 2002; Lim & Saleh, 2002; Raymond, 1997; Russo & Rennie, 2003; Seah et al., 2001) further confirmed the strength of adopting qualitative methods in researching values, beliefs and attitudes.

The primary method of investigating the immigrant teachers' socialisation experience with value differences will be the grounded theory tradition, first introduced by sociologists Barney Glaser and Anselm Strauss (Glaser & Strauss, 1967). This fits the aim in this study of generating a theory concerning the nature of value differences perceived by immigrant teachers in the Australian mathematics classroom, and these teachers' ways of negotiating these value differences, a theory which the preceding chapters have shown to be relevant and indeed essential in the current socio-cultural context of mathematics education, but also one which is yet to be developed. Creswell's

(1998) overview and comparison of the different qualitative research traditions had also affirmed the grounded approach as the most appropriate for inquiries into the research questions posed for this study (see Creswell, 1998, p. 65). Also, the prime analytic task being conceived for this study is typical of studies featuring this grounded theory tradition, that is, to "uncover and explicate the ways in which people in particular (work) settings come to understand, account for, take action and otherwise manage their day-to-day situation" (Van Maanen, 1979, cited in Miles & Huberman, 1994, p. 8).

Indeed, the understanding of each teacher participant's experiences and responses as being culturally-situated reflects a research approach that treats each set of teacher participant data as also being emic, as opposed to etic (see Berry, 1969), the emic/etic distinction having been made by Brislin (1983):

> The need for achievement ... includes the etic of goal setting, but the Japanese emic is that goals can be group oriented, and in the US they are more frequently individual oriented. (p. 383)

Official approval from the university's human ethics committee and from the relevant school boards will be sought for before sampling and data collection begin (refer to Appendices 1-3 for the approval letters). In particular, permission to conduct research in Catholic secondary schools was obtained from the different branches of the Catholic Education Office, that is, Archdiocese of Melbourne and the Dioceses of Ballarat, Sale and Sandhurst. As the nature of these four letters of permission are similar, only the reply from the Archdiocese of Melbourne is included here, as Appendix 3. Data for the current study will be collected through lesson observations, interviews, and document analyses. These different collection methods serve to control "personal biases that stem from single methodologies" (Denzin, 1989, p. 236), help to uncover greater richness and diversity of the phenomenon being studied, as well as provide multiple sources of data due to the differences inherent in different methods (Neuman, 1997). Thus, a feature in the research design of this study is the collection of data through observing teacher participants' teaching (in addition to conducting interviews and analysing documents). The main concern prompting the choice of this data gathering method (i.e. lesson observations) is the individual's ability to identify such internalised and subconscious constructs as values (which account for the culturally-based differences perceived by the teacher participants in this study). Seah et al. (2001) reported that teacher participants were not very successful in identifying mathematics content and pedagogical values which they were about to introduce in their respective lessons; the researchers attributed this phenomenon

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to factors such as the lack of a shared vocabulary with which to discuss values and related concepts, teacher participants not finding it worthwhile/significant to nominate particular values, and teacher participants not being aware of values being portrayed in the first place. After all, "many values remain unconscious to those who hold them …. They can only be inferred from the way people act under various circumstances" (Hofstede, 1997, p. 8). Research methods such as questionnaire administration and interviewing are ideal for the study of cognitive-affective constructs which we are conscious of (Schlöglmann, 2001), but may not be able to identify the full range of values underlying culturally-based differences and conflicts. At the same time, teacher participants may also not feel comfortable to initiate verbal or written discussion about particular values (Merriam, 1988), but may feel alright to discuss them in the context of their practice and interaction in class, which is facilitated through lesson observations.

The lesson observations would also serve as a worthwhile data source for another reason. The discussion (in the previous chapter) of competing, overriding and second-hand values, as well as the acknowledgement that values exist as part of personal value systems, had supported observed inconsistencies between articulated values/beliefs and subsequent actions. Making observations of the teachers' practice in the classroom would thus provide opportunities for this relationship between what are professed and what are portrayed to be explored. This will also validate information derived from the interviews and document data.

For the same reasons, collecting data from observing teacher practice and interaction in the classroom alone will not likely yield reliable interpretation of the teachers' socialisation experience. Not only will this suffer from the shortcomings inherent in the use of single methodologies (discussed earlier), but interpretations of what is observed can be difficult when teacher actions may be grounded in several possible underlying values. This research difficulty was reported by Russo and Rennie (2003) in a study on a related cognitive-affective variable, attitudes:

> Overall the children seemed to enjoy science lessons, although it was difficult to separate what seemed to be their joy of science from pleasure derived from social interactions, the handling of equipment, and the opportunity to conduct some personal explorations. (p. 77)

Various types of documents or artifacts had been analysed in related studies. Raymond (1997) examined teacher written records of lesson planning. Leu (1998) analysed students' compositions with the aim of checking for student consciousness of

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teacher values representation. Seah (1999) compared Australian and Singapore mathematics textbooks for writer/editor/publisher portrayal of mathematics content and pedagogical values. In this study, document analyses will involve the examination of school survey slips, teacher questionnaires, as well as teacher assessment of student written work.

The school survey slips provide information from heads of mathematics departments regarding the number of immigrant teachers teaching mathematics in their respective schools, and the home cultures of these teachers. The collated information, to be presented via descriptive statistics, is expected to provide us with snapshots of the group of immigrant teachers of secondary mathematics in Victoria. It may also provide updated relevant contextual information for the purposes of interpreting the data collected and of understanding the findings of this study.

The questionnaire will be designed to probe for teacher self-reported values, self-classifications and behaviour (Neuman, 1997). The teacher participants' responses will also provide discussion points during the interview sessions with them (Baird, Gunstone, Penna, Fensham, & White, 1990; Neuman, 1997).

Another set of documents to be collected for content analysis will be a set of marked assignments to be collected from each of the teacher participants. The way a teacher assesses student work, as well as the comments she includes (or omits) in the work, reflect teacher expectations and responses to pupil input. Underlying these expectations and responses are expected to be the teachers' mathematics content and pedagogical values. As LeCompte, Preissle and Tesch (1993, chap. 6) pointed out, "artifacts [made and used by humans] constitute data indicating people's sensations, experiences, and knowledge and which connote opinions, values, and feelings" (p. 216). Tripp (1993) made a more general, but no less relevant, observation: "all writing expresses and disguises dispositions, particularly values. Sometimes what a writer writes says more about the writer than about the phenomenon they write about" (p. 92). The analysis of teacher assessment and comments directed at individual pupils is also a means of examining teacher-pupil relationships (Merriam, 1988), especially since teachers have greater opportunities to treat pupils of different cognitive abilities and cultural backgrounds differently in individual assignments.

Scheduled interviews with teacher participants is not just another source of data and information; they also allow for clarifications on issues identified in the other two data collection methods, that is, lesson observations and document analyses. In this regard, Patton (1980) summed up very well the power of interviews:

> We interview people to find out from them those things we cannot directly observe .... We cannot observe feelings, thoughts, and intentions. We cannot observe behaviors that took place at some previous point in time. We cannot observe situations that preclude the presence of an observer. We cannot observe how people have organized the world and the meanings they attach to what goes on in the world --- we have to ask people questions about these things. The purpose of interviewing, then, is to allow us to enter into the other person's perspective. (p. 196)

3.2 Sampling Procedure

As this study intends to explore values related to mathematics and mathematics education, it will be desirable that lesson observations, interviews and document analyses be carried out with teacher participants who are practising in the context of mathematics teaching and learning. Leu's (1998) experience with a generalist (elementary school) teacher whose expressed concerns were inevitably not subject-specific is to be avoided. As such, this study will only focus on teachers of mathematics practising in secondary schools, such that their decisions, actions and interactions in mathematics lessons may be examined with them.

It is expected that potential teacher participants will not be excluded just because they have been in Australia for a considerable length of time. As adult immigrants, the value systems they have acquired in their respective home cultures are expected to be stable. That is, these teachers probably continue to perceive their environment in Australia with values associated with their home cultures even after years of arrival here. Hofstede (1997) supported the view of development psychologists that "by the age of ten, most children have their basic value system firmly in place, and after that age, changes are difficult to make" (p. 8). Assimilation into the mainstream culture does not necessarily take place, and even if it does, this applies mostly to the second-generation and beyond (Hofstede, 1997), perhaps due to the socialisation experiences of these children from young, such as in schools. Court's (1999) three teacher participants might have migrated from the Soviet Union in 1990-1991 to Israel, but they were all able to demonstrate how cultural difference has influenced their respective professional practice when data were collected from them in 1997. Similarly, the two veteran (of 12 to 20 years of teaching experience) teachers in Madsen and Mabokela's (2000) study perceived the same kinds of

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organisational pressures against them as were felt by the 'younger' teachers. The difference between these veteran teachers and their less-experienced counterparts, however, was that the former group had at their disposal finely-tuned defence strategies to respond to the institutional pressures.

So, the focus of this study will be on immigrant teachers who had been educated as students — and trained as teachers — overseas prior to their arrival in Australia. This group of teachers had grown up and developed their personal value systems in their respective home cultures. Immigrant teachers who were teacher-trained in Australia, however, would not be included in the current study because it would be inevitable that some of the value conflicts would have been perceived, negotiated and resolved during the teacher training course in Australia. As a result, the cultural baggage which these teachers would otherwise bring with them into their professional practice may have been significantly mediated during these courses. Opportunities for the perception of 'culture shock' in the Australian classroom would also be reduced without the experience of teaching similar topics in their respective home cultures.

The sampling of teacher participants will not be probabilistic in nature. There are several explanations for this. Generalisability is not a salient objective of this study (LeCompte et al., 1993); the cultural diversity among the teacher participants is potentially so great that it will not be fair to regard value differences as arising from some common foreign worldview, not even if all teacher sources are grouped according to broad geographical divisions such as Europe or Asia. Statistical sampling is also irrelevant because there is no access to the whole group (LeCompte et al., 1993) of immigrant secondary teachers of mathematics in Victoria. A recent national report acknowledged that data for Australia's teacher supply and demand at the level of subject specialisation have not been comprehensive (Australia Department of E cation, Science and Training, 2003). In particular, although the various teacher accreditation agencies maintain archived records of teacher migrants who applied to practise in schools in the state, these records do not indicate if these teachers are teaching mathematics currently, or teaching in schools at all. Also, in a study such as this which provides initial description of a hitherto little known phenomenon (i.e. value differences perceived by immigrant teachers of mathematics), statistical sampling is not a crucial element (LeCompte et al., 1993).

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The first step in the sampling procedure will be to establish initial contact with a pool of immigrant secondary teachers of mathematics in Victoria who may be interested in participating in the study. Such a teacher would

— be teaching in a state, Catholic or independent secondary school/college in the state of Victoria in Australia,

— be teaching school mathematics at one or more secondary levels, that is, between Year 7 and Year 12 (inclusive),

— have taught secondary school mathematics in another country or region outside Australia, and

— have received school mathematics and teacher education in one or more countries or regions outside Australia.

As discussed earlier in this section, the various teacher accreditation agencies' records will not be useful in identifying this pool of 'eligible' teachers. Thus, they will be tracked through survey forms to be sent out to heads of mathematics departments in all Victorian state, Catholic and independent secondary schools and colleges in August 2000. The mail-out (Appendix 4) will seek the assistance of the heads of mathematics departments to provide a list of immigrant teachers teaching mathematics in their respective schools, as well as the home culture of each of these teachers. Responses may be returned either in the reply-paid envelope enclosed with the survey form, or via fax transmission.

Based on the responses received from the heads of mathematics departments, individualised invitations to fill out the teacher questionnaire will be posted to the eligible immigrant teachers. To enhance publicity and the response rate, an advertised insert (Appendix 5) will be made in Issue 166 (July, 2000) of 'Common Denominator', the regular newsletter of the Mathematical Association of Victoria, the state's mathematics teachers professional association. This insert provides information about the research study and contact details for further information and for copies of the questionnaire.

Prospective teacher participants will then be selected from the gathered pool of interested respondents through criterion-based selection (LeCompte et al., 1993), also known as purposive sampling (Merriam, 1988). In particular, teachers will be selected to represent a selected range of profiles, although this number will understandably not correspond to their respective proportions in the Victorian teaching service. For the

purpose of the current study, this differentiated profile will include, first of all, a representation from state, Catholic and independent school teachers. Different educational systems articulate different institutional value statements in general, which influence the context within which value differences are perceived and negotiated. These different school sectors may also support teacher professional socialisation in different ways, though this does not imply that any generalisation distinguishing the three sectors may be usefully made. Secondly, since most of Victoria's immigrants settle in metropolitan Melbourne, student and community exposure to — and tolerance of — cultural difference is expected to differ amongst schools in metropolitan Melbourne, in the rural cities, and in the countryside. It is thus desired to also sample teachers according to the locations of their schools with respect to these three broad geographical groupings. Thirdly, Hofstede's (1997) cultural value dimensions illustrated how the degree to which the teacher's home culture differs from the Australian dominant culture will affect the intensity of value differences perceived, and the manner with which these are subsequently negotiated. There is a need, then, for teacher participants to represent the different broad cultural groups, such as the British, American, Asian and African. Lastly, human affective sensitivity, tolerance and style of management have often been divided along gender lines. Thus, the desired teacher sample will also aim to have a balanced representation of men and women.

It is expected that about eight immigrant teachers will be thus selected, and subsequently accept the invitation to participate in the study. Invited teacher participants will be briefed with the help of a letter of explanation (Appendix 6). Through classroom observations, regular personal interviews and document analyses, insights will be gained into the nature of value differences which these teacher participants perceived to have encountered, and the ways in which they manage the resultant dissonance. A 'Teacher Profile Record File' will be maintained for each of the teacher participants, in each of which personal and other background information, raw research data, transcripts, as well as inference and analytic notes will be gathered to facilitate the conception of an overall picture of particular teacher participant's experience with — and negotiation strategies related to — value differences. Specifically, each perceived value difference situation will be mapped onto a single page of what is called the logic diagram, by summarising (and cross-referencing) the nature of the value difference, the context within which it takes

place, the particular teacher's responsive action, and the assumptions and considerations underlying the response (see Appendix 7 for an example). These one-page mappings will allow for summaries of individual teacher's negotiation process to be made on the one hand, and facilitate holistic understanding of how different value differences may be related for particular immigrant teachers on the other hand.

3.3 Data Collection Process

Data for this study will be derived from survey slips returned by heads of mathematics departments in schools, immigrant teacher questionnaire responses, classroom observation notes (and transcripts of lessons), transcripts of teacher interviews, and analyses of teacher assessment of student written work.

3.3.1 School Survey Slips

The school survey slips (Appendix 8) will be posted to heads of mathematics departments in all state, Catholic and independent secondary schools in Victoria. The aim is to collate a list of immigrant teachers of mathematics practising in the state as in (school) Term 4 of 2000, together with their home cultures. An emphasis will be made on home culture rather than home country, in recognition of the various different cultures that may co-exist in any country (e.g. Singapore Chinese versus Singapore Indians, or White American versus African American). Schools will be advised that they can return these slips either by conventional mail (using the enclosed reply-paid envelopes) or by fax transmission.

3.3.2 Teacher Questionnaire

The design of the teacher questionnaire (Appendix 9) is aimed at collecting background (personal) information about the immigrant teacher respondents, as well as gathering data regarding these teachers' practices and opinions in Australia and in their respective home cultures. It requires respondents to indicate their own degree of agreement to relevant value statements, preference among alternatives, and open-ended responses which will reflect their experiences in cultural comparisons and differences in mathematics teaching and learning. These questionnaires will be posted to immigrant teachers identified in the school reply slips, together with explanation/invitation-to-participate letters and reply-paid return envelopes. The questionnaire is designed for self-

administering, so that teacher respondents can fill out the questionnaire items at a place and in a time suited to their convenience.

The main structure and layout of the 12-page questionnaire will be based on a related teacher questionnaire designed, pilot-tested and administered in the 'Values And Mathematics Project', in which I was involved as a research assistant. There are three sections to this study's questionnaire. The first section gathers basic identifying information from the teacher respondents, such as home culture, gender type, and present school system type. The last section allows the respondents to indicate their desire (namely, yes, maybe, no) to participate in the subsequent stage of the research study.

The middle section of the questionnaire will constitute the main source of research data from the questionnaire. The way the three parts to this section is arranged represents progressively insightful reflections that will be required to respond adequately. Also, by arranging the three parts in this way, it is hoped that respondents would have been sufficiently sensitised to the notion of 'values' and its related vocabulary by the time they are invited to respond to the open-ended items. Specifically, the three components to this section will be made up of:
— 24 statements, each of which is associated with a Likert-scale five-c ..gory response set (ranging from strongly agree (1), to neutral (3), to strongly disagree (5)), and arranged in a matrix question format,
— 7 sets of items which teacher respondents will be asked to rank-order, from most favoured (1) to least favoured, allowing for the use of the same numeral to represent a tie in rank, arranged in a vertical response format, and
— 3 open-ended questions, each with 4 sub-questions.

The content design of the items will be guided by the research questions (see Section 2.4). In particular, the open-ended items ask for responses relating to teacher perceived significant value differences in the ways academic mathematics knowledge, school mathematics knowledge, and mathematics pedagogical knowledge respectively exist in their home culture and in Australia. For each of these, respondents will also be invited to write down what they think are the underlying cultural values that account for the differences, how these influence respondents' own professional practice, and the way(s)

in which external factors facilitate or inhibit respondents' attempts at negotiating about these perceived differences.

Within each of these three parts in the middle section, the statements/questions are arranged to reflect a shift in context from socio-cultural to personal, within each of which is another layer of ordering from knowledge of the mathematics discipline to school mathematical knowledge, and lastly, within each of which is a focus shift from home culture to host (Australian) culture. The items will thus be basically arranged in a funnel sequence, i.e. from general to specific/personal issues so as to control for order effects (see Neuman, 1997, p. 246). Respondent open-ended comments will also be sought for at the end of the two sets of close-ended items for additional comments or clarifications.

It may be noticed among the questionnaire items that a distinction is made between academic mathematics and school mathematics. This is to avoid affecting the validity of responses arising from respondent misinterpretation between these two kinds of mathematics, as reported by Schoenfeld (1989) when one of his questionnaire items was phrased as follows: 'In mathematics something is either right or it's wrong'. In that study, there was concern that different respondents might have been thinking of different 'types' of mathematics in interpreting the phrase.

The questionnaire design allows for respondent anonymity, and each immigrant teacher will be informed in the invitation letter that responding to the questionnaire does not oblige her to proceed to the subsequent stage of the study.

All items in the questionnaire are reviewed during the drafting and the pilot-testing stages for clarity and applicability. References to question writing tips and guidelines in methodology guidebooks are made (such as the ten question writing rules in Neuman, 1997, chap. 10). Respondent recall, a common issue affecting the quality of questionnaire data, is hopefully enhanced through the provision for respondents to fill out the questionnaire at a time and place of their convenience, so that they would be feeling more at ease with themselves and with the activity.

A draft version of the questionnaire will be pilot-tested with fellow researchers experienced in questionnaire design and administration. Comments on item wording and order will be considered, and required improvements made, leading to the final version being presented in Appendix 9.

The closed-ended responses from all the teacher responses will be presented by descriptive statistics to illustrate a representative picture of the ways in which value differences are perceived and negotiated by immigrant mathematics teachers in Victoria. The teacher participants' responses to the open-ended items in the questionnaire, on the other hand, will constitute part of the text data for qualitative content analysis, a technique suitable for the purpose (Neuman, 1997, chap. 11).

3.3.3 Lesson Observations

As the teaching landscape is never fixed and constant, novel situations will happen from time to time during a teacher's experience in a classroom. For immigrant teachers, these will likely to surface irrespective of their respective years of teaching experience in Australia. The decisions made by the teacher during such decision points in class will be a focus of the data-collecting exercise in the class. The term 'decision point' is similar to Bishop and Whitfield's (1972) notion of 'teaching situations', Bishop's (1976) idea of 'decision-making incidents', or Tripp's (1993) 'critical incidents'. That is, while any perceived value difference is likely to bring about dissonance, and wh', it is human nature to address this inequilibrium (see Section 2.3.2), it will be assumed in this study that the choice of a responsive approach with the class in progress represents an interruption in the teaching plan. In so doing, a decision point has been attended to. Lesson observation will thus focus on identifying such moments during any particular class, as a means of stimulating particular teacher participants to discuss the values underlying the response to each decision point.

The observed lessons will also be an indirect source of data regarding value differences which may have since been resolved by the teacher participants. This is especially significant in the case of teacher participants who had been teaching in Victoria for some years, who had successfully negotiated about several value conflicts, and who may not identify these as differences as a result. As resolved conflicts, they may not be immediately identifiable since they will be part of the lesson flow and teacher norms. In this sense, the degree to which I succeed in entering the world of each teacher participant will thus determine the extent to which I will be able to discern what would otherwise be normal proceedings in a lesson from the particular teacher participant's point of view. Such episodes will then act as triggers for follow-up discussions with the teacher participant concerned.

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Three lessons of each teacher participant will be observed. The duration of each observation will be kept short to maintain researcher concentration, so only the first period of any double-period sessions will be observed. In these sessions, the researcher's role will essentially be that of a nonparticipant. As LeCompte et al. (1993) pointed out, this noninteractive mode of observation is ideal for a study such as this which looks for a comprehensive, detailed and representative account of an individual's (teacher's) behaviour.

With the help of a lesson observation checklist (Appendix 10), observation data will be recorded in two ways for ready and systematic retrieval and analysis, i.e. note-taking and audio-video recording. Instead of trying to write something down as much as possible and as exactly as possible as it occurs, the organisation of the field notes will be in the form of jotted notes. Taking jotted notes during the classroom observation sessions enhances researcher sensitivity to events and phenomena (Neuman, 1997). With the accompanied use of audio-video recording, the importance and significance of the jotted notes is no longer so much as a memory trigger. Rather, these will highlight verbal and nonverbal significant points during the lessons which may be worth further exploration during post-lesson and subsequent interviews with the teacher participant concerned, complemented with the video playback if necessary. Specifically, a teacher participant's response to decision points will be compared with her emerging profile. This profile will be progressively established during the course of the study from input in the teacher questionnaire, preliminary conversation, and prior lesson observations and interviews.

Audio-video recording is chosen over audio-only recording in order to capture non-verbal communication and contextual details. An examination of non-verbal cues and messages would also be helpful in achieving a better understanding of the communication processes involving ethnic and cultural factors which may be unfamiliar to me. Observed situations of interest will then be clarified with the particular teacher participant during the post-lesson interviews. Since only jotted notes will be taken during the lessons observed, the video recordings will also be used to produce the transcripts of the lessons for data analysis. Over the recent years, technological advances has meant that audio-video cameras are not as obtrusive in appearance as they used to be. The increasingly widespread use of these cameras in home/holiday videos and web videos has also meant that people do not generally feel uneasy or uncomfortable in the presence of a video-

camera. Furthermore, under the guidelines of the university Ethics Approval Committee, the video images will not to be retained as data. Data analysis will be conducted from written transcripts only, and the tapes will be destroyed after these transcripts are made.

Practice with the use of the observation checklist will be conducted with commercially available video-clips of mathematics lessons-in-progress. Not only will practice familiarise me to what needs to be observed, these trials also have the potential to improve researcher attention to details and short-term memory (Neuman, 1997).

3.3.4 Teacher Interviews

An initial conversation will be conducted with a teacher soon after she is identified as a teacher participant (see Appendix 11 for the interview questions and stimulus statements). The aims of such a meeting are essentially to allow both me and the teacher participant to get to know each other, to establish opportunities for the development and growth of trust, to put the teacher participant at ease, to clarify any issue she may have, and to make practical arrangements for the lesson observation visits (including meeting with the teacher participant's principal to explain the study and to gain permission for access to the school). In turn, this may lead to the beginning of "a relationship that is conducive to a respondent's explanation of beliefs and attitudes given the special features of the interview situation" (Mishler, 1986, p. 29). Other than jotted notes, the conversation will not be tape-recorded in line with an aim of the meeting, being to establish trust between me and the teacher participants.

An interview with each teacher participant will be held after each of the lessons observed. Appendix 11 also includes the post-lesson interview protocol. These sessions will play an essential role in confirming the perceptions of value differences during the previous lesson, and in seeking for teacher explanations for these differences. After all, what is observed and interpreted of a teacher participant's decisions and actions are functions of the researcher's knowledge, personal experience and sensitivity, which may very likely differ from the teacher participant's viewpoints and considerations. Even what may appear to the researcher to be a clear-cut portrayal of particular value in a lesson may well turn out to be an articulation of some other, overriding values. That is, the range of values particular teacher participants subscribe to can hardly be established through observation by an 'outsider' alone. Thus, decision points and relevant incidents which

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take place during the lessons observed will be used to initiate face-to-face conversation with the teacher participants. This 'checking back' confirmations and clarifications with the teacher participants is also impɔrɔnt from another perspective: that the researcher is by nature not value-free can potentially affect interpretations regarding the values relating to the immigrant teachers' professional lives. Regular discussions with teacher participants on what appears to be observed, and an acute attention to what the teacher participants share in such interactions, should present an effective strategy to validate any conclusion drawn in this study.

Here, interview discourse will be treated as narratives. Mishler (1986) had expressed concern that the 'standard' conception of interviewing as involving behaviour (rather than talk) effectively "allows, and indeed encourages, interviewers and analysts to treat each question-answer pair as an isolated exchange .... [so that it] excludes explicit recognition of the cultural patterning of situationally relevant talk" (Mishler, 1986, p. 11). As a result, there are 'technical' problems such as variation across interviewers and unreliability of coding, requiring 'solutions' such as, respectively, training interviewers and elaborate coding manuals. Furthermore, it is envisaged that treating the interactions as narrating would be particularly relevant to the nature of this study, involving the immigrant teachers' different cultural mores relating to patterning of their speech.

Another (related) problem with the standard interviewing approach is the adoption of a stimulus-response paradigm, in which interview questions were viewed as stimuli to obtain interviewees' verbal responses. This implies the need for equivalent stimulus effects for all interviewees in any research study, which in turn requires standardisation of questions. The problem is that even with careful planning towards this end, they are seldom actualised in practice, and Mishler (1986) presented several research reports to support this point. In addition,

> the question-answer format guides and organizes the discourse of interviewers and respondents, but they are talking together, not "behaving" as stimulus-senders and response-emitters. It is their general competence as language users and not simply interviewing "skills" or techniques that underlies their abilities to engage in this type of talk. (pp. 21-22)

In this context, therefore, the interviews with the teacher participants will be semistructured (Merriam, 1988) in nature. The flow of such an interview process is flexibly and loosely guided by a list of questions and stimulus statements. Semi-structured interviews not only help to deliver questions of similar meanings (rather than

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questions of similar wording/phrasing) to the different teacher participants, they are considered suitable for the intended study because they allow for the flexibility to respond to different culturally-based patterning of speech, and to emerging situations, viewpoints, ideas and worldviews. In addition, each teacher participant will be briefed on the nature and focus of each post-lesson interview session, thereby providing her with some degree of consistency in expectation.

Note-taking will be complemented by audio-recording in each of these interview sessions. The practice of taking notes is expected to be useful in cueing the teacher interviewee of the importance of what has just been said, as well as being useful in pacing the progress of each interview session (Merriam, 1988).

During the interviews, there will be no attempt to correct teacher participants' statements or opinions, whether they refer to self, matters pertaining to their respective home cultures, or matters pertaining to the Australian (host) culture. After all, "empirically false interview statements can have real consequences for the subjects' behavior" (Kvale, 1996, p. 222), a phenomenon termed as the Thomas theorem in sociology. In fact, accepting these 'false' statements as they are helps to establish a better interpretation and explanation of teacher participants' responses and strategies in dealing with value differences in their respective mathematics classrooms.

Talking about one's own values can be a very private matter commonly reserved for very close friends, although the extent to which this is the case can vary across different cultures. The topic may also appear threatening to an individual: Clarkson, Bishop, FitzSimons and Seah (2000) observed that "the subject of 'values' seems to immediately provoke in many teacher [sic] notions of judgement and finding fault" (p. 158). Unwillingness by participants to bare their affective qualities has also been research difficulties that were reported by both Chin and Lin (1999a), and Leu (1998) in their respective studies, Thus the 'recursive probing approach' advocated by Chin and Lin (1999a) will be employed during the interview sessions. Probes for further clarifications and/or elaboration will be given sometime later if it is felt that a teacher interviewee is able to offer them more comfortably given this other opportunity. These probes may be 'planted' later in the same interview, or even in one of subsequent interviews. That said, it is recognised that should a teacher participant demonstrate continued discomfort to

discuss particular topics, her wish to move on to another conversation topic (or to terminate the conversation) should — and will — be respected.

My role as interviewer has also to reflect my approach in treating interviews as the production of narratives. In acknowledging that a story is being told to me, I have to be mindful of allowing the immigrant teacher participants to talk without imposing time limits or boundaries on what I perceive to be relevant information. Although I may be expected to hold the initiative to control the 'agenda' of any interview session, I will recognise that I should act as the teacher participant's audience once she 'takes over the stage', so that the teacher participant can present her story in the way she intends to.

3.3.5   Teacher Assessment of Student Written Work

Teacher participants will be informed that the ways they score/grade and comment on student written work provide additional sources of data for the purpose of better understanding how value differences are negotiated. There is also the possibility that immigrant teachers may react to such dissonance situations differently, given the more private and personal nature of assessing student individual work. In this context, teacher participants will be invited to share with me any chosen set of marked assignments, which will constitute textual data for qualitative analysis. To maintain student anonymity, students' names and other possible identifying marks will need to be removed prior to the teacher participants making a copy of the assignments for submission to me.

3.4   Data Analysis

3.4.1   Analysis of Quantitative Data

In this study, quantitative data will be gathered from school responses to the survey slips, as well as from the first section of the questionnaire. The main purpose is to construct, through descriptive statistics, a contextual background of the state of immigrant teachers practising in Victoria at the time of this study. It is expected that more meaningful interpretation of the collected data can take place against such background information.

3.4.2   From Voice Recordings to Verbatim Transcripts

As discussed earlier, voice data will be collected from audio-video recordings of lessons observed and audio recordings of post-lesson interviews. These voice recordings will be transcribed into written text for analysis. As discussed earlier, video images recorded do not constitute data for analysis in this study. To increase transcription reliability, only what was heard clearly and distinctly will be transcribed, thereby reducing incidents of guessing particular utterances. Since false-starts and hesitations will not be the foci of analysis for the purpose of this study, they will also be excluded so that the transcripts can be presented in a more coherent, 'reader-friendly' manner.

Thus, the transcripts will not represent a written version of the reality of the interviews and classroom interactions. Nor should they be. After all, "transcripts are artificial [and interpretative] constructions from an oral to a written mode of communication" (Kvale, 1996, p. 163) to help in the visualisation of the shared interactions.

3.4.3   Coding of Text Data

Interpretation of all written data (from the teacher questionnaire, lesson transcripts, interview transcripts, and teacher assessment of student written work) in this study will be conducted from the perspective that these constitute narratives. As pointed out by Kvale (1996), a narrative

> contains a *temporal* sequence, a patterning of happenings. It has a *social* dimension, someone is telling something to someone. And it has a *meaning*, a plot giving the story a point and a unity. One of the main social functions of narratives is to maintain social ties: The narratives of a group contribute to constituting the group's identity and to holding the group together. (p. 200)

In such a context-rich form of discourse, the conventional assignment of codes or tags to flag units of meanings to chunks of information in data text is not likely to be able to reflect the true meaning of isolated words, sentences or simple paragraphs. For the same reason, this study will not involve the use of qualitative analysis software such as 'QSR NUD*IST', since these programs tend to assign codes according to a search for pre-determined terms. As Kvale (1996) noted, the "technical ease of coding and of analyzing isolated variables ... [leads to] a neglect of the contextual base of interview statements in the narratives of lived conversations" (p. 174).

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Furthermore, for these immigrant teachers who have not yet mastered an extensive (Australian) English vocabulary, the use of generic terms such as 'nice' and 'good' to convey meanings of different intensities of emotions can only be differentiated by examining the context of the relevant conversation or written text. Also, that this study will involve speakers from different linguistic cultures would also mean that it cannot be presumed that the same (English) word or phrase refers to the same meaning between and among the home and Australian cultures. Neither can it be assumed that their frames of reference are similar. Rather, the treatment of narrative data "entails the temporal and social organization of a text to bring out its meaning. It focuses on the stories told ... and works out their structures and plots" (Kvale, 1996, p. 192).

In this light, the coding exercise will follow a three-stage process as defined by Strauss (1987, cited in Neuman, 1997), i.e. open coding, axial coding, and selective coding. Creswell (1998) summarised the steps involved:

> In open coding, the researcher forms initial categories of information about the phenomenon being studied by segmenting information. Within each category, the investigator finds several properties, or subcategories, and looks for data to dimensionalize, or show the extreme possibilities on a continuum of, the property.
>
> In axial coding, the investigator assembles the data in new ways after open coding. This is presented using a coding paradigm or logic diagram in which the researcher identifies a central phenomenon (i.e., a central category about the phenomenon), explores causal conditions (i.e., categories of conditions that influence the phenomenon), specifies strategies (i.e., the actions or interactions that result from the central phenomenon), identifies the context and intervening conditions (i.e., the narrow and broad conditions that influence the strategies), and delineates the consequences (i.e., the outcomes of the strategies) for this phenomenon.
>
> In selective coding, the researcher identifies a "story line" and writes a story that integrates the categories in the axial coding model. In this phase, conditional propositions (or hypotheses) are typically presented. (p. 57)

It is during the open coding stage that codes will be first assigned to text data to flag units of meanings. The codes used are shown in Appendix 12. There are four main categories of codes. The first, with the leading letter 'T', is associated with information about the teacher participants. The other three categories are related to the three types of perceived value differences, namely mathematical, mathematics educational, and general educational (see Section 2.2.5).

A focus on meanings has meant that codes will not strictly be assigned to particular words or phrases in a rule-bound fashion. Similarly, since the telling of a story is often also framed implicitly by the narrator's values, beliefs and assumptions, a comprehensive interpretation of each narration should be guided by what is told, and what is behind what

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is told. Agar and Hobbs' (1982) three independent levels of discoursal themes, or 'coherence' would be useful for the purpose of this study, namely: local, global, and themal.

The open coding phase will thus be expected to be conducted in three passes, with each pass over the text data focussing on local, then global, then themal coherence.

The open-coded data for each teacher participant will be expected to be labelled on the teacher questionnaire, transcripts (of lessons and interviews) and student assignments. A sample page of a coded transcript of a lesson, and another from a post-lesson interview, have been included as Appendix 13 to demonstrate what these codes look like. These chunks of information will then be grouped by value differences and presented in logic diagrams (such as in Appendix 7) in the axial coding phase. In each of these, what Creswell (1998) referred to as the 'central phenomenon' will be the particular perceived value difference. Figure 3.1 demonstrates how the various components in the logic

Figure 3.1. The components of a logic diagram.

Perceived value difference

- causal condition(s)
- context (incl home culture's values)

- what the value difference looked like
- effect on teacher participant

- teacher responsive strategies
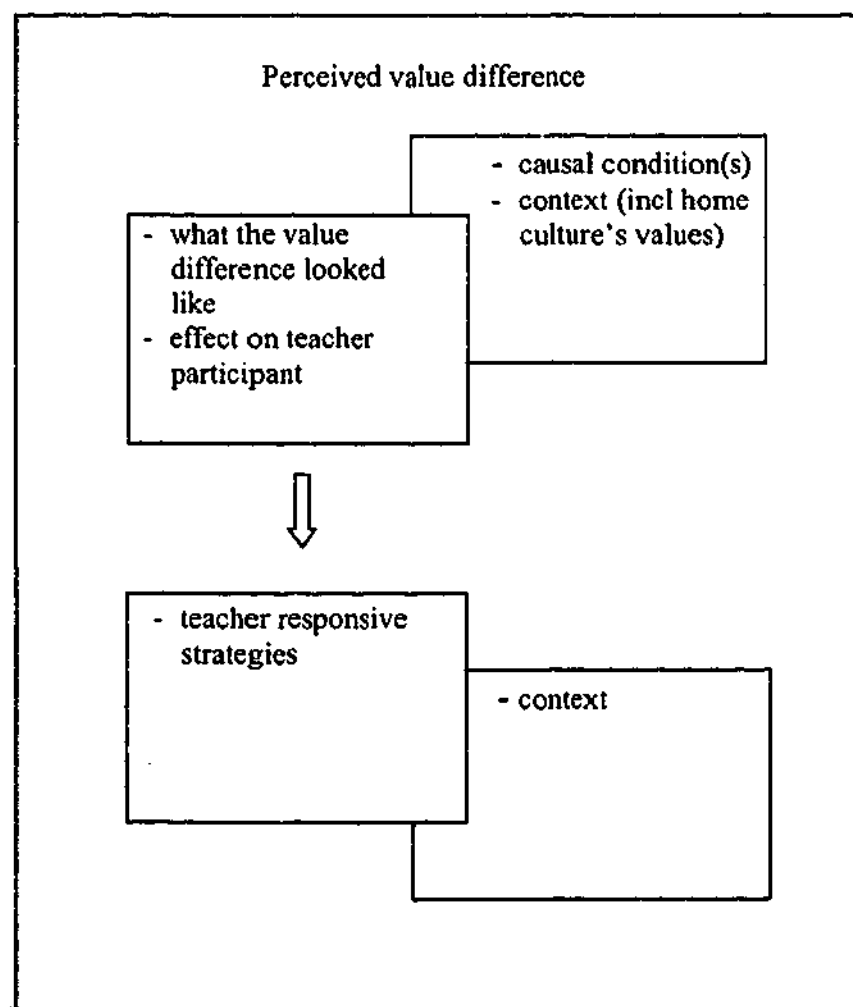
- context

diagram will assist the exploration of context, causal conditions, and strategies that are relevant to each of these central phenomena, and that will be identified through the coding structure. This arrangement of the logic diagram also enables relevant data to be pulled together from different sources and from different parts of the same data source (e.g. from different interviews). As cross-referencing will allow me to relate particular data to its context if necessary, each logic diagram will be constructed in a visual, one-page format containing only the key summary information. "Valid analysis requires, and is driven by, displays that are focussed enough to permit a viewing of a full data set in the same location, and are arranged systematically to answer the research questions at hand" (Miles & Huberman, 1994, pp. 91-92). An example of a logic diagram to be composed in the course of conducting this study will be presented in Appendix 7.

3.4.4 Interpretation of Meanings from Coded Data

Analysis of coded data in the selective coding phase will not only aim at making sense of the teachers' negotiation of each perceived value difference, but also to construct a coherent story that brings all the value difference experiences together for each teacher participant. These will be summarised in the form of a matrix display (see, for example, Table 5.3) for each teacher participant to facilitate cross-case interpretation and explanation.

As is characteristic of qualitative studies, my relationship as researcher with the teacher participants is a legitimate factor and has to be recognised. The quality of such relationships impacts on what the teacher participants and I will say and/or do. While my cultural and professional positioning will certainly heighten my sensitivity to the collected data, it may also lead some teacher participants to assume particular shared knowledge / experience in the process of working with me. Thus, what a teacher participant says, how she says it, and why it is said will be interpreted in the light of my relationship with the teacher participant at the time of the interaction. In a way, it may be argued that replicability of this study by someone else will be difficult, if possible. But, it is precisely a feature — and possibly a methodological strength — of adopting a socio-cultural approach that different researchers can hear different messages from the same narrative anyway. The way forward, then, other than acknowledging such a factor in the data analysis phase, is to make explicit these shared assumptions and knowledge as they become relevant in the context of this study.

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The result of the entire data analysis process is expected to be a substantive theory of what value differences look like for immigrant teachers, and of how these teachers respond to them, grounded in data collected in the study (see Chapter 6). It is also important to examine the conceptual significance of conclusions drawn (Miles & Huberman, 1994). Thus, another outcome of the substantive theory will be a discussion of this in the context of literature reviewed and ideas put forward (e.g. Table 2.3), as well as of concepts which become significant as the data are being interpreted. These will be presented in Chapter 7.

CHAPTER 4

RESULTS OF SCHOOLS AND TEACHERS' SURVEY

The previous chapter had described the research methodology for this study. It was proposed there that in the light of no known prior research into the professional lives and experiences of immigrant teachers of mathematics in Victoria, the interpretation and understanding of the qualitative data obtained for this study would benefit most from a knowledge of the context in which these professionals practised. It was also proposed in Chapter 3 that this information would be most efficiently presented mainly through descriptive statistics, with data to be obtained from feedback in a state-wide school survey exercise, as well as from responses to questionnaires distributed to immigrant teachers of mathematics in Victoria. This chapter presents this mainly quantitative information.

4.1 Schools' Survey of Immigrant Teachers

In this first section, information about the home countries, destinations, and nature of mathematics pedagogical duties of immigrant teachers of secondary mathematics in Victoria will be presented. Survey forms (Appendix 8) designed to collect demographic data and to identify immigrant teachers of mathematics were sent to all state, Catholic and independent schools in Victoria in August 2000, as planned. A full-page insert in Issue 1ʌ6 (July 2000) of the mathematics education newsletter, 'Common Denominator', was targeted at generating publicity about — and raising awareness of — the study, especially amongst immigrant teachers. That the advertisement was sent a month before the survey forms were sent out was to allow time for the newsletter to be circulated amongst teachers of mathematics in the different schools. Although no teacher had responded directly to the advertisement, several of the teacher participants in the study mentioned having come across the insert in the newsletter.

An impromptu decision was made to circulate the insert for publicity purpose in early December, 2000 at the Mathematical Association of Victoria's Annual Conference, an in-service professional development conference for school teachers of mathematics. This annual event traditionally attracts more than two thousand teachers from Victoria, together with a smaller number of teacher educators as well as participants from interstate and overseas. This exercise was executed personally at the trades display hall during the

Conference. To avoid the possible bias collation of immigrant teacher numbers, the handouts were distributed to each passing Conference participant, whether he or she appeared to be an immigrant or not. It was hoped that 'local' teachers would pass the handouts to their immigrant colleagues anyway. Several contacts were established, especially those whose head of mathematics did not reply to the demographic survey forms. Face-to-face encounters with three of the teachers who had either agreed or who later agreed to participate in the study were made. Two of these were among the 8 teacher participants to be featured in this study.

The survey data were fed into an electronic spreadsheet (Appendix 14) as they were received. Each entry was prefixed as either being valid (1) or otherwise (0) to facilitate follow-up clarifications with schools and with electronic sorting of data, whereby a valid entry refers to one where all associated column entries (as shown in Appendix 14) were registered. To preserve teacher anonymity in this thesis report, each immigrant teacher of mathematics was assigned an ID in the format of 'x-y', where x corresponds to the school number (reflected on the survey slips) and y, the first, second, etc immigrant teacher listed in that particular school's survey returns.

The home culture of each immigrant teacher was denoted by the IDD access code corresponding to the country she came from. Unless particular respondents had supplied extra information (as in the case for those from Fiji), it was assumed in this study that the home culture referred to the dominant culture of the respective countries. Some teachers, however, did not make a clear distinction amongst the cultures in the respective countries they came from. For example, teachers 157-1, 160-1 and 160-2 were Chinese Malaysian immigrant teachers, and although they indicated their home culture to be Malaysian, the Chinese Malaysian culture differs from the dominant (Malay) Malaysian culture in some ways.

On the other hand, it was interesting that teachers from Fiji made a distinction between being culturally indigenous Fijian (code: 6790) or Indian Fijian (code: 6791) (679 being the IDD code for Fiji, the fourth digit distinguishes between the two cultures). This differentiation signalled a significant difference between these two cultures (which was validated in greater detail by one of the teacher participants, Manoj), and these two home cultures were subsequently assigned different home culture categories (Oceania and Asia, respectively).

The home culture categories basically correspond to the inhabited continents in the world, as shown in Table 4.1.

Table 4.1

Home Culture Categories

Category	Home culture	
1	Britain / New Zealand	
2	Oceania,	excluding New Zealand (and Australia)
3	Asia,	including Russia and Turkey
4	Middle East	
5	Africa	
6	Europe,	excluding Britain
7	America	

Immigrant teachers from Britain or New Zealand have been assigned an independent home culture category. This recognises these two countries as traditional sources of migration to Australia, such that the fabric of the Australian society is expected to be historically similar to the Anglo-Saxon tradition that is characteristic of Britain and New Zealand.

Table 4.2

Education System Categories

Category	Education system
1	state
2	Catholic
3	independent

Table 4.3

School Region Categories

Category	School region
1	metropolitan Melbourne
2	regional city
3	rural Victoria

Schools were also categorised by education system (see Table 4.2) and geographical region (see Table 4.3) to facilitate further distinction of factors relevant to our understanding of immigrant teachers' professional lives and experiences. Categorisation of schools by education system was a straight-forward exercise, informed by the lists of schools available at different education boards in the state. As for categorising schools'

geographical regions, it was felt that the addition of the 'regional city' category to the urban/rural dichotomy would acknowledge and recognise the different level of support and services available to teachers in these administrative/financial centres of rural Victoria. These regional cities were identified using the 2000 data published by the Australian Bureau of Statistics (2001); they were all located outside the Melbourne Statistical Division, denoted as cities at the Statistical Subdivision level, and each had a population exceeding 50 000 in June 2000. Four such regional cities were thus identified, as listed in Table 4.4.

Table 4.4

Victorian Regional Cities

Regional city	Population on 30 June 2000
Geelong	191 018
Bendigo	87 918
Ballarat	81 981
Shepparton	56 537

Note. Data from "Victoria: Population by age and sex," by Australian Bureau of Statistics. Copyright 2001 by the Australian Bureau of Statistics.

The survey slips were sent out to a total of 369 state, Catholic and independent secondary schools in Victoria, of which 160 replied. As is expected in the exercise of feedback collection, some of these returns were not completed fully. Of the 34 of these schools with incomplete returns, all but one did not give the number of teachers of mathematics in their respective schools (see Appendix 8). This one school provided only the immigrant teacher's name and his home culture, and nothing else. Since the majority of the contextual information to be discussed in this chapter will not concern the population of all teachers of mathematics in schools, the data from which information will be drawn will derive from the 159 schools (unless otherwise stated).

There were 110 immigrant teachers of mathematics in the 159 schools. Given the number of schools, and given that only teachers who were teaching mathematics in these schools were of interest, 110 should not be perceived as a negligibly small number. Put in context the 369 secondary schools in Victoria in 2000 (Australian Bureau of Statistics, 2002), this translates to 255 immigrant teachers of secondary mathematics if the 159 schools were considered a representative sample. Valuing each individual teacher's contribution to Australia's (mathematics) education notwithstanding, the emerging global trend of human capital transfer/exchange will only see an increase in the number of

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immigrant teachers (of mathematics) in the near future. Understanding the experiences of the current, small group of immigrant teachers thus positions us to further facilitate the professional socialisation into Victorian schools of future groups of immigrant teachers (of mathematics).

4.1.1 Sources of Immigrant Teachers of Secondary Mathematics in Victoria

The 110 immigrant teachers had come to Victoria from 34 different countries. A third of these teachers, however, originated from the top three sources. As shown in Figure 4.1, these were (in order) UK, Malaysia, and USA. Together, they made up 33.64% of the immigrant teachers surveyed. Given that USA has never been a major source of immigration to Australia, what this means is either that the proportion of teachers differs amongst different nationalities of immigrants (i.e. there was a relatively high proportion of teachers amongst American immigrants to Australia), or that Victoria has been an especially attractive state of settlement amongst American teachers.

Figure 4.1. Home cultures of immigrant teachers of secondary mathematics in Victoria in 2000
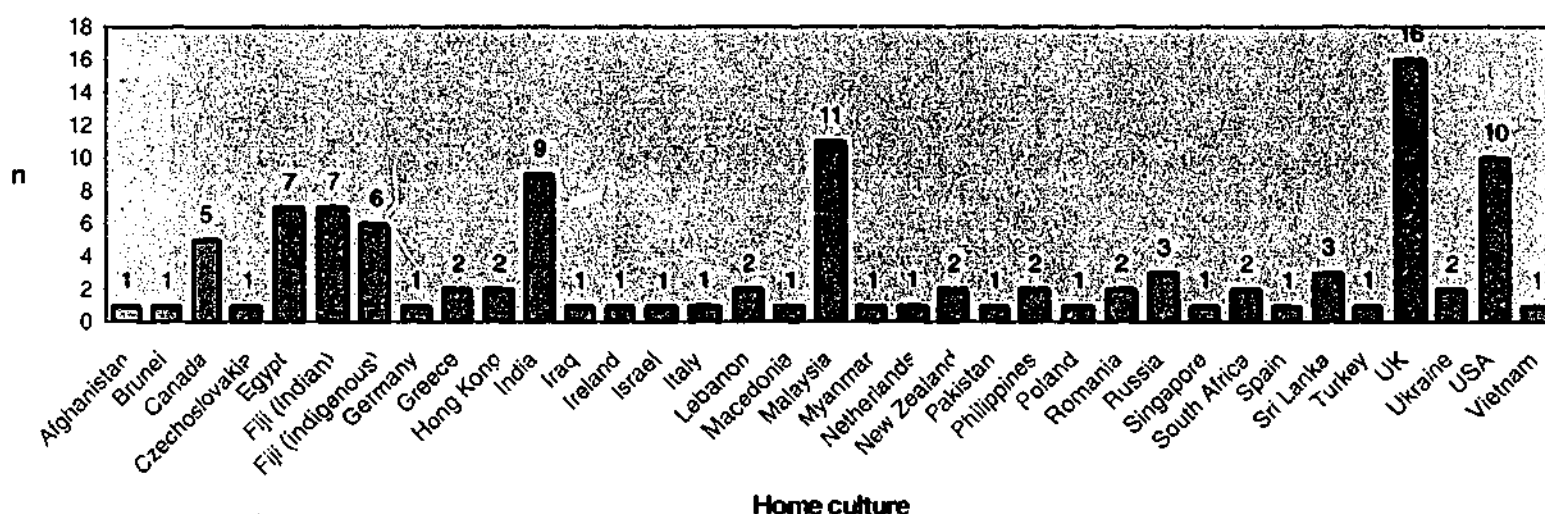
On the other hand, the number of immigrant teachers of mathematics amongst the proportionally large number of immigrants from New Zealand was relatively small. This observation further implies that teachers of mathematics are not likely to move across countries in the same way that most other professionals do. In turn, this is likely to also reflect the state of professional health and of the supply and demand of mathematics teachers in the different source countries.

In terms of the broader grouping of home culture categories, it may be seen from Figure 4.2 that Asia accounted for more immigrant teachers than any of the other six home culture categories. More than 1 in 3 of the immigrant teachers surveyed had come from one of the 13 countries with dominant Asian cultures (12 in Asia and 1 out of Asia, in Fiji). This may be the combined result of Australia's emphasis on skilled migration and a high number of immigrants from Asian cultures (including Fiji Indians) in the recent years (see Section 1.1). This also implies that mathematics teaching is probably generally believed to be culture- and value-free, such that practising mathematics teachers from countries in culturally-different Asia (and from other regions) were probably not deterred by the idea of moving to — and teaching in — Australia.

Figure 4.2. Home culture categories of immigrant teachers of secondary mathematics in Victoria in 2000.
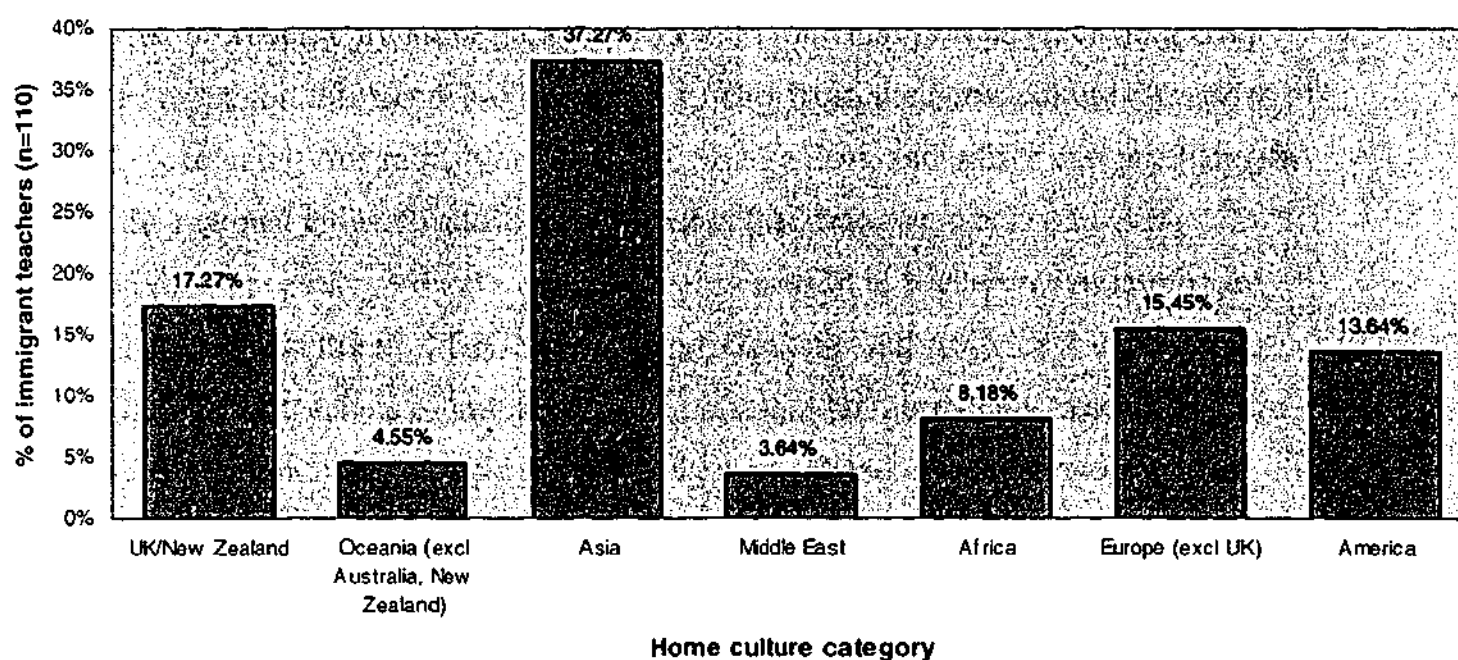
On the other hand, while Oceania (excluding Australia and New Zealand) might represent the smallest culture by population count, there were more immigrant teachers from these nations in Oceania than those identifying themselves with a home culture in the Middle East. This may reflect the traditionally high volume of demographic outflow from the Pacific islands to Australia and New Zealand, the destinations being the islands' traditional governing nations and/or financial donors.

4.1.2 Destinations of Immigrant Teachers of Secondary Mathematics in Victoria

Given that schools in Victoria are governed by different education systems (state, Catholic, independent) and are understandably located in different geographic locations (metropolitan Melbourne, regional city, country Victoria), it will also be informative to explore if immigrant teachers from different home cultures were practising in particular patterns in terms of professional communities. Figure 4.3 shows how the immigrant teachers of secondary mathematics surveyed were distributed differently in the state. Most of Victoria's population resided in metropolitan Melbourne, with the four regional cities registering the least population count (in part due to the way the regional cities were defined in relation to country Victoria in this study) (Australian Bureau of Statistics, 2001); as a group, the immigrant teachers surveyed also demonstrated this trend (refer to the last cluster of columns in Figure 4.3). If the data is examined by home culture categories, however, only immigrant teachers from Asia and Europe (excluding UK) appeared to exhibit this trend. No immigrant teacher from the home culture categories of Oceania (excluding Australia, New Zealand), Middle East, and Africa was practising in any of the regional cities. In addition, it appeared that there were either an over-concentration in country Victoria or under-representation in Melbourne of immigrant teachers from the cultures of UK/New Zealand, Oceania, and America. Ethnic Anglo-Saxon immigrant teachers of mathematics, then, might be more likely to settle in more 'traditional' communities outside the relatively ethnically-diverse metropolitan Melbourne.

The immigrant teachers' 'distribution' amongst the three education systems also followed the state's trend for all teachers in general, as demonstrated by the last cluster of columns in Figure 4.4. That is, there were more teachers in the state education system than any of the other two systems, with the independent schools accounted for the least number of teachers. However, when analysed in terms of home culture categories, this trend was observed only amongst teachers from the Asian and African cultures, although all the cultures did have at least half of their immigrant teachers practising in state schools. The cultures of UK/New Zealand and

Figure 4.3. Distribution of immigrant teachers of each home culture category in Melbourne, the regional cities, and country Victoria.

home culture category

☐ Melbourne ■ regional city ☐ country Victoria
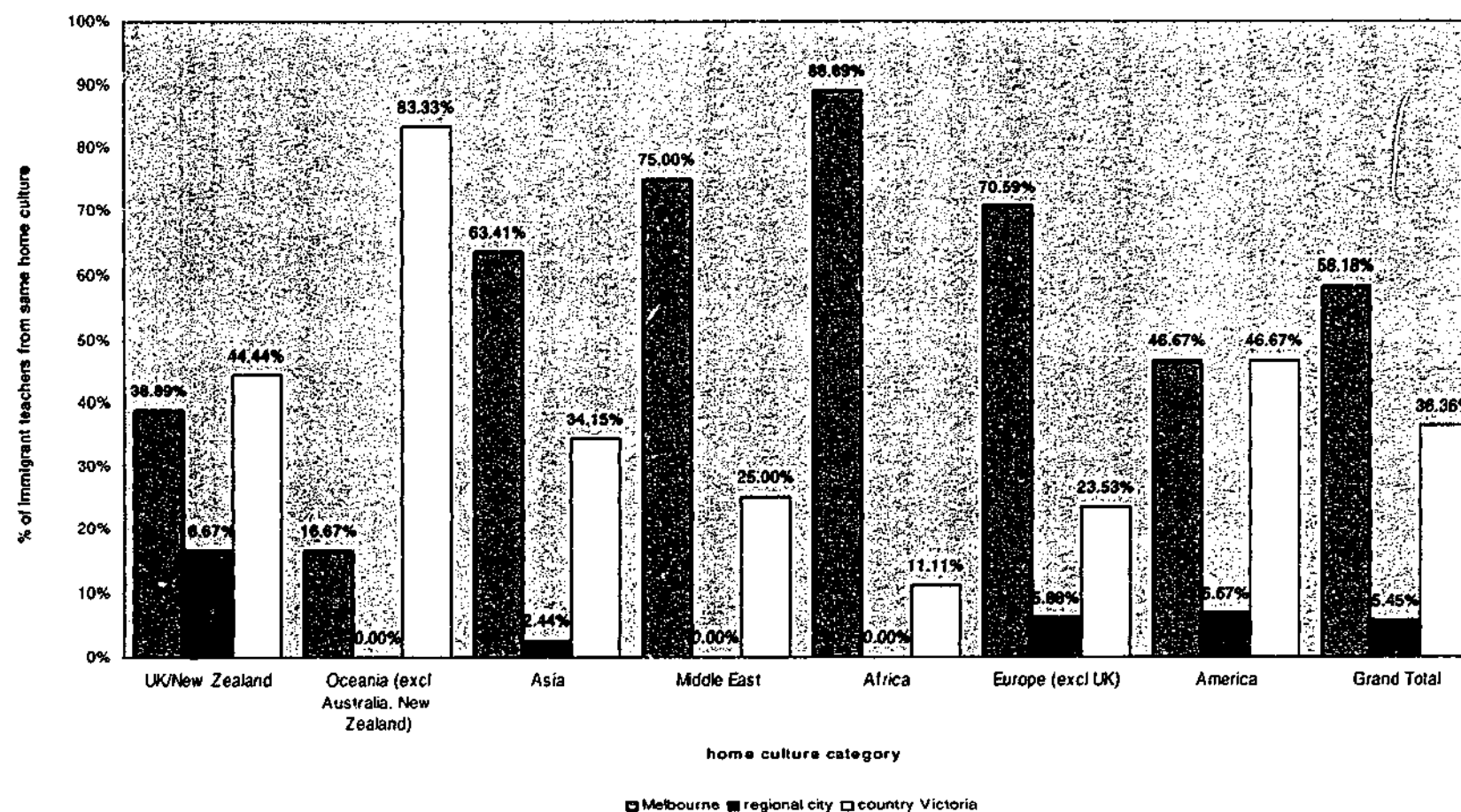
Europe saw more teachers teaching in independent schools than in Catholic ones. Furthermore, teachers from the American and Middle Eastern cultures were evenly divided between the Catholic and independent systems.

It is noteworthy that only immigrant teachers from Asian and European (excluding UK, but including Eastern European) cultures registered state school percentages of deployment that were higher than the state considered as a whole (as illustrated in the last cluster of columns in Figure 4.4). Does this imply a general affinity to the state education system by these groups of immigrant teachers, or does it suggest a relative greater difficulty with which teachers from these cultures were able to practise in non-government schools?

In these communities of practice within which immigrant teachers of secondary mathematics functioned, to what extent were their colleagues also immigrant teachers? Bearing in mind that some of the 160 response schools did not provide the total number of mathematics teachers in their survey reply slips, this information could only be deduced from those schools which did. There were 126 of these.

These 126 schools had a total of 85 immigrant teachers of mathematics amongst a total of 1 288 such teachers, translating to a proportion of 0.066 (or 6.6%). Without the benefit of testing for statistical significance, it may be noted that the respective proportions in Tables 4.5 and 4.6 corresponding to schools in regional cities and to Catholic schools were lower than the other three corresponding values for each table. In fact, the proportions for the state as a whole, schools in Melbourne, and schools in country Victoria, as well as the proportions for the state as a whole, state, and independent schools, were comparable within each group.

Table 4.5

Proportion of Immigrant Teachers of Secondary Mathematics to All Teachers of Mathematics in Victoria in 2000, by School Location

School location	Melbourne	Regional city	Country Victoria	All
Proportion	$\frac{47}{698}$ (0.067)	$\frac{6}{141}$ (0.043)	$\frac{32}{449}$ (0.071)	$\frac{85}{1\ 288}$ (0.066)

Figure 4.4. Distribution of immigrant teachers of each home culture category across different school systems in Victoria, 2000.
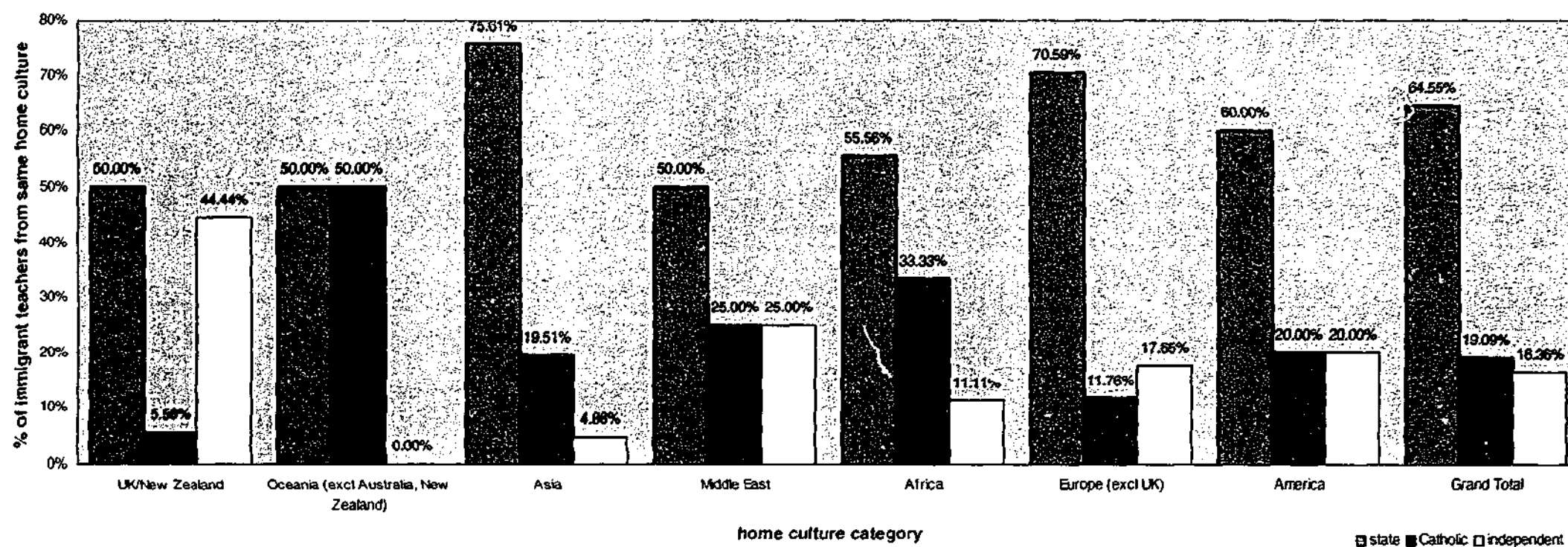
Table 4.6

Proportion of Immigrant Teachers of Secondary Mathematics to All Teachers of
Mathematics in Victoria in 2000, by Education System

Education system	State	Catholic	Independent	All
Proportion	$\frac{51}{700}$ (0.073)	$\frac{16}{326}$ (0.049)	$\frac{18}{262}$ (0.069)	$\frac{85}{1\,288}$ (0.066)

Let us examine this from another perspective, that is, at the level of individual
schools. Comparing across school locations, Figure 4.5 indicates that for regional cities,
the 75th percentile (upper quartile) for the proportion of immigrant teachers was the
lowest (0.071) while the corresponding values for the state (0.111), schools in Melbourne
(0.111), and schools in country Victoria (0.118) were comparable. Clearly, the
mathematics teaching staff in secondary schools in the regional cities were less
multicultural than schools elsewhere in the state.

Also, Figure 4.5 shows that the median proportion of immigrant teachers in schools in
metropolitan Melbourne was higher than schools elsewhere, and also higher than the state
considered as a whole. That is, while half the schools outside Melbourne did not appear to
have any immigrant teachers in their staff, half of the schools in Melbourne had at least
5.88% (the median in-school proportion of immigrant mathematics teachers in
metropolitan Melbourne secondary schools) of immigrant teachers ˆmathematics
amongst their mathematics teaching ᴖtaff. The inter-quartile range for the proportions of
immigrant teachers in Melbourne was also visibly and considerably smaller than schools
elsewhere. Thus, not only were immigrant teachers most likely to practise in Melbourne
than anywhere else in the state (see Figure 4.3), there appeared to be a relatively more
even spread of these immigrant professionals in schools across the city.

Figure 4.6 illustrates the in-school proportion of immigrant mathematics teachers by
education systems. The lowest 75th percentile obtained for individual schools' proportions
of immigrant teachers in Catholic schools was expected, given that on the whole, the
proportion of immigrant teachers in this education system was the lowest (see Table 4.6).
Another noteworthy feature of Figure 4.6 is the highest median value (0.103) for
individual state schools' proportions of immigrant teachers, accompanied by the smallest

Figure 4.5. In-school proportion of immigrant teachers of mathematics in secondary schools in 2000 in Melbourne, the regional cities, and country Victoria.
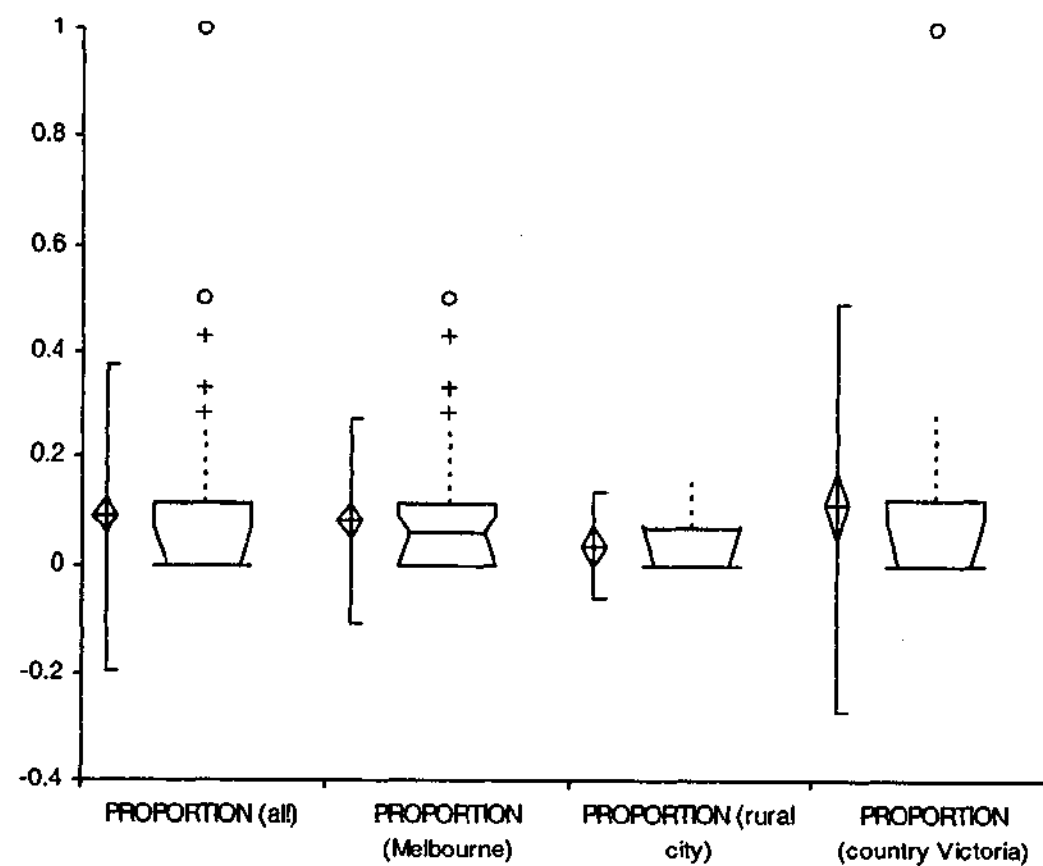
Figure 4.6. In-school proportion of immigrant teachers of mathematics in state, Catholic and independent secondary schools in 2000 in Victoria.
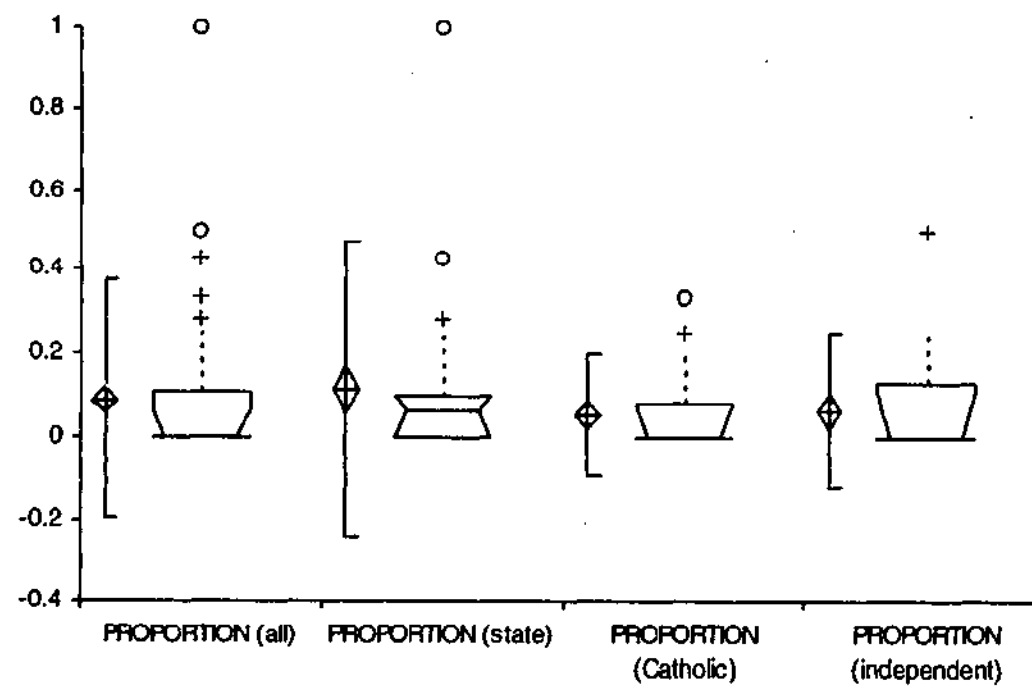
inter-quartile range compared to the other two education systems, and compared to the state as a whole. That is, half of the state schools in Victoria had at least 10.3% of their mathematics teaching staff being immigrants. Coupled with the small inter-quartile range, these suggested that the employment of immigrant teachers in state schools was rather evenly distributed across these schools.

4.1.3 Mathematics Subjects Taught by Immigrant Teachers

Moving a level narrower, it will be informative to also explore the distribution of the immigrant teachers amongst the four different types of school mathematics subjects offered in schools at the time of the survey. These subjects were:

— mathematics (Year 7-10), taught in the first four years of the secondary school system,

— General / Further Mathematics,— Mathematics Methods, and

— Specialist Mathematics,

the last three of which are the four mathematics subjects offered at the pre-tertiary levels in the last two years of the six-year secondary school system, and with which students may sit for the Victoria Certificate of Education (VCE) examinations. In particular, the difficulty level and abstractness of school mathematics are generally regarded as increasing from General/Further Mathematics, to Mathematics Methods, then Specialist Mathematics.

This information was only collected in the questionnaires distributed to the 110 immigrant teachers of mathematics reported by the responding schools. A total of 35 of these teachers returned the completed questionnaires, so these 35 teachers made up the pool from which information for the rest of this chapter was obtained.

Figure 4.7 shows the percentage of the 35 teachers that were teaching each of the four mathematics subjects in schools in Victoria. Since most teachers were teaching more than one mathematics subject, the percentages of the four bars in the chart add up to more than 100%. Understandably, given that the subject 'mathematics (Year 7-10)' was offered across four years in schools (as opposed to two years for the other three subjects), all but two of the 35 immigrant teachers (94.29%) were involved in teaching this subject in one

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Figure 4.7. Distribution of immigrant teachers of secondary mathematics in Victoria in 2000, across mathematics subjects taught.
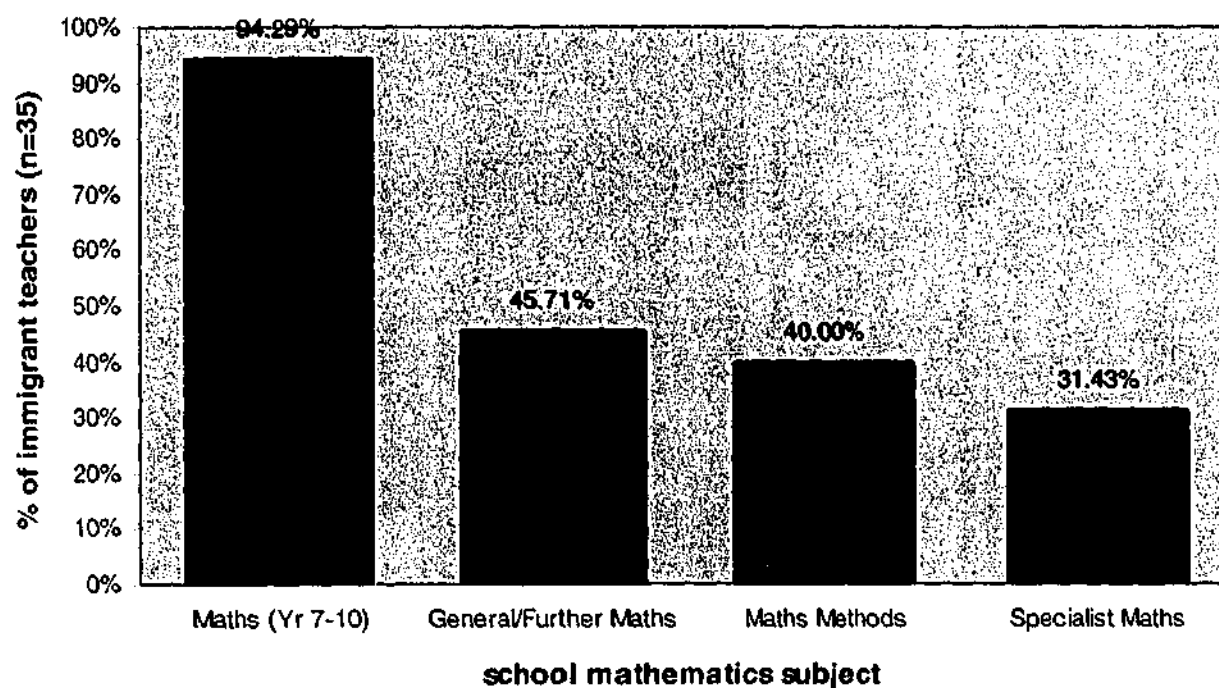
or more of the grade levels of 7 to 10. Also, of the 35 immigrant teachers, 26 of them were teaching at least one of the three VCE mathematics subjects. In this context, that 31.43% of these 35 immigrant teachers were conducting lessons for Specialist Mathematics may be a reasonable figure, especially since the number of students enrolled in Specialist Mathematics is traditionally lower than the other school mathematics subjects.

Examining the same set of data by home culture category, however, offered a different insight, as demonstrated by Figure 4.8. In general, the composition of each column in the figure indicates that all the home culture categories appeared to differ from

Figure 4.8. Relative probability within home culture categories of teaching the different mathematics subjects in 2000.

Maths (Yr 7-10) ◪ General/Further Maths ▢ Maths Methods ▢ Specialist Maths
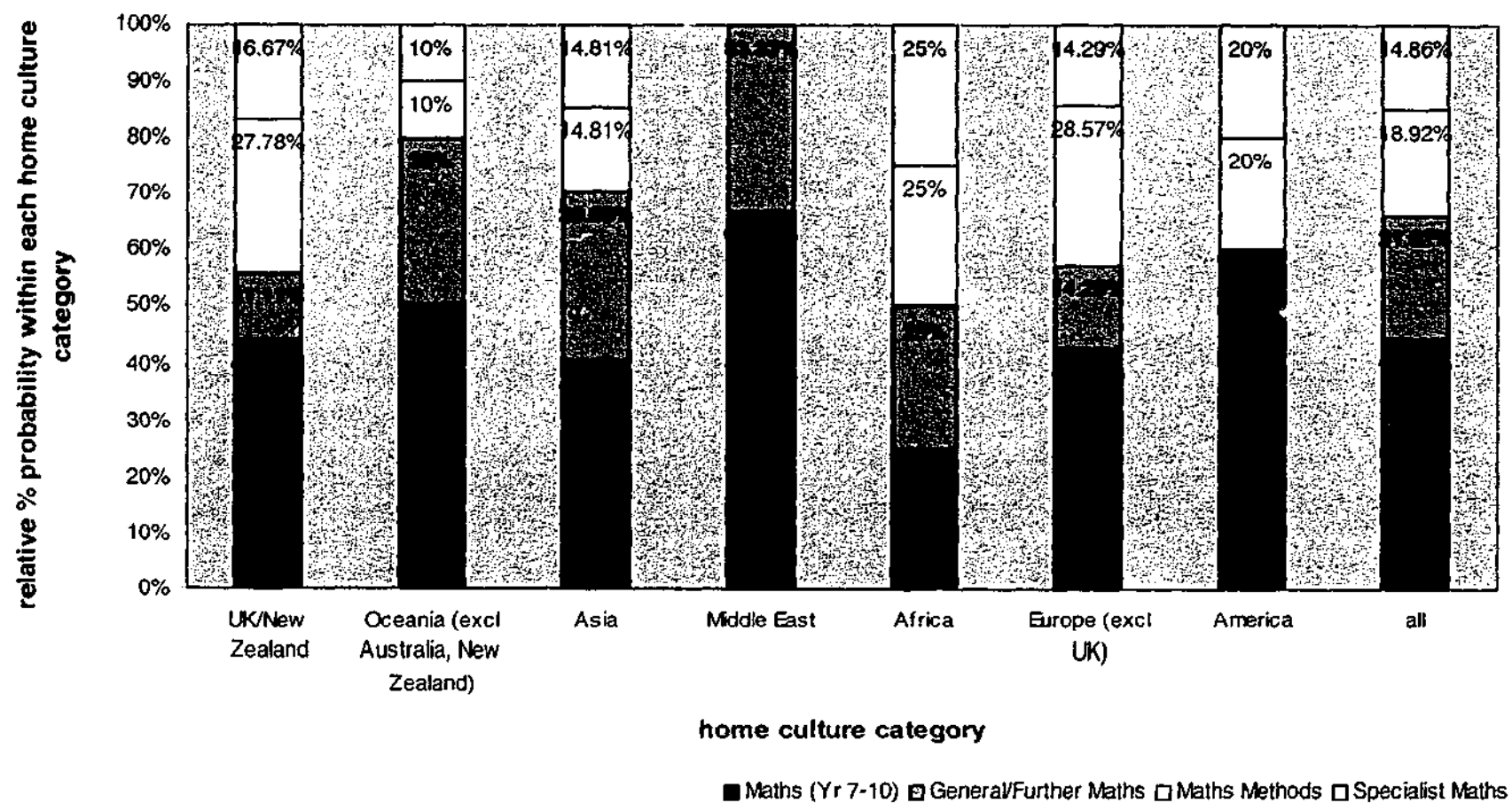
one another in the relative probability of teaching each of the school mathematics subjects, and none of these home culture categories resembled the relative probability for the group considered as a whole (last column of Figure 4.8). Also, none of the three teachers from the American culture was teaching General/Further Mathematics, and none of the two teachers with the Middle Eastern culture taught either Mathematics Methods or Specialist Mathematics in 2000.

4.2 Survey of Value Differences Perceived by Immigrant Teachers of Secondary Mathematics

This second major section of the chapter draws information from the responses to the teacher questionnaires distributed to immigrant teachers, who were identified in the state-wide postal survey mentioned in Section 4.1 The questionnaire included three open-ended questions, each inviting teacher respondents to share a most significant difference perceived in the Australian classroom relating to, namely, mathematical knowledge, school mathematics, and mathematics education (i.e. mathematics teaching/learning). Each question also asked teacher respondents to propose possible underlying cultural values, to write about how personal professional practice in Australia had been influenced by the perception of the value differences, and to explain the extent to which school and wider communities, and their policies, had afforded or constrained the immigrant teachers' attempts at responding to the differences reported. These are certainly relevant to the research questions posed for this study, and will be explored in greater detail with the eight teacher participants. The following provides only an outline of how the 35 questionnaire respondents reacted to the questions (amongst whom were 6 of the 8 teacher participants of this study). A summary of the responses to the open-ended items is also enclosed in this study, as Appendix 15.

4.2.1 Nature of Value Differences

Amongst the 35 questionnaire returns, the number of culturally-based differences perceived and reported by the immigrant teachers in the questionnaire was the highest in regards to school mathematics, followed by mathematics education, then mathematics as a scientific discipline. As argued in Chapter 2, and as reflected in the teachers' feedback (see column 3 of Appendix 15), these culturally-based differences may be grounded in

differences in how aspects of mathematics and mathematics education were valued in the teachers' home cultures and in Australia. In other words, they were value differences.

Value differences that were related to mathematics as a scientific discipline were not reported by immigrant teachers from cultures of the Oceania and America. This may suggest that at the level of regarding mathematics as a form of knowledge at least, teachers from the Pacific islands may share similar values to their colleagues from Australia. Could this be the result of Australia's politically and ideologically dominant role and presence in the Pacific island nations? Similarly, could the apparent absence of mathematical value differences for (continental) American immigrant teachers be taken to reflect the contemporary dominance of American worldviews and ways of life in the Australian society?

For the other immigrant teachers who had responded to the questionnaire, the general view of perceived differences was that mathematics as a discipline had not been treated seriously by the Australian society. Underlying cultural values cited by the teachers included the degree to which different societies valued education and success, which were related to the historical and economic factors peculiar to different societies. An immigrant teacher from Hong Kong (questionnaire 15) wrote of her observation:

> The Australian culture promotes a more relaxed attitude towards life and subjects like Art and Graphics where people [who] express their feelings flourish while subjects where students have to exercise their logic are considered too hard and only for some elite group. (p. 9)

Many of the teacher respondents also did not appear to relate the notion of values (or valuing) to mathematics and mathematics education. Comments like the following were often made before the open-ended questions in the questionnaire, that is, the open-ended questions seemed to prompt them to relate values to the discipline of mathematics:

> I do not come across any conflicting cultural values in my mathematics classes [in Australia]. Mathematics is a universal subject and is not affected by culture. (questionnaire 28, p. 8)

Twenty-six of the 35 questionnaire respondents reported 40 perceived value differences related to the school subject of mathematics. These respondents had represented all the home culture categories used in this study. That is, whilst teachers from the cultures of Oceania and America did not report any cultural difference relating to the valuing of mathematics, they perceived differences in the way school mathematics was structured in Victoria and in their respective home cultures. The most commonly reported value difference referred to a perception that the school mathematics curriculum

in Victoria emphasised more on the *applications* aspect of mathematical knowledge, and correspondingly less on the *rigour* of the discipline.

Many of the teachers believed that the school mathematics value differences arose from differences in values at the political and societal levels. A British immigrant teacher wrote that

> the greater emphasis on applicability [in the Victorian school mathematics curriculum] reflects what I see as a 'Pacific Rim' philosophy (and which I blame largely on America!), that something is only worth doing if it can lead ultimately to a profit of some kind! (questionnaire 7, p. 9)

Another British immigrant teacher reflected on how the different social values in UK and in Australia had shaped the mathematics curricula in the two countries:

> class structure acceptance in the UK. Understanding that we have limitations and may not all have the same opportunities because of that. More social engineering in Australia .... To make all [people] equal. (questionnaire 31, p. 9)

In terms of mathematics education, that is, the teaching and learning of school mathematics, 14 of the 35 teacher respondents reported 21 related value differences. None of the teachers identifying themselves with cultures of Middle East and America appeared to perceive any value difference in this aspect of their professional practice. The most commonly cited value difference related to mathematics education was the (greater) emphasis of *information and communications technology* (ICT) use in mathematics teaching and learning in Victoria.

Again, as in the other two categories of value differences, many of the values underlying the perceived differences were historical, political and societal in nature. For an immigrant teacher from Myanmar, his perception of a difference in the valuing of mathematics education was apparently the result of scarred memories of life experiences in his home country:

> The significance [sic] difference between ... [Burmese and Australian perceptions of the mathematics discipline] is none, in the way that, both samples originate [sic] from the same culture, predominantly English. But the way it is taught is culturally different. One is taught with a cane, the other is by means of positive appraisal. (questionnaire 35, p. 10)

4.2.2 Responsive Approaches to Perceived Value Differences

The teachers' approaches to perceived value differences were discerned from their reflection on how these incidents had influenced their practice in the Australian classroom, which were summarised in the column headed 'influence on teaching' in

Appendix 15. With reference to the conceptualised range of teacher approaches (outlined in Table 2.3), the responses in the questionnaire provided evidence that the five approaches (i.e. cultural-blind, assimilation, accommodation, assimilation, appropriation) were adopted in different situations by the immigrant teachers, although no attempt is being made to match these approaches to the teachers' proclaimed practices. Also, no one teacher negotiated value differences exclusively with any one particular approach.

It was also evident that these approaches helped the immigrant teachers negotiate the value differences by addressing in particular the values that were different and which apparently underlied what were manifested. For example, whilst four immigrant teachers (questionnaires 5, 15, 20, 32) had reported four different value differences relating to school mathematics and mathematics education, the underlying difference in values was similar, that is, pertaining to Victorian students' attitude to and motivation in learning mathematics. As a result, these four teachers' responsive approaches — while being different — were all chosen to address the way their students in Victoria valued the learning of the subject. That is, there was no evidence in the data collected that the teachers' responsive approaches were targeted at the observable differences. For instance, the teacher submitting Questionnaire 15 noticed a difference in displayed competencies between students in Victoria and in her Asian home-culture. Instead of addressing this observable difference, such as through providing drills exercise, the teacher's responsive approach was one of motivating her students in Victoria, as a means of attempting to modify their relaxed attitudes towards the subject, which was the cultural difference she identified as underpinning the perceived value difference. Thus, the teachers appeared to (subconsciously perhaps) recognise the central role that values play in value differences, and to actively seek for ways to resolve the situations by addressing the 'root' cause.

Importantly, it appeared that not all perceived value differences were negotiated successfully. A British immigrant teacher (questionnaire 8) wrote about how he continued to feel frustrated at the relatively less emphasis placed by students in Victoria on keeping notes and learning facts. It was not clear, however, if any prior attempt was made by the immigrant teacher to resolve the value difference (and what that approach might be), or if a sense of helplessness was present from the very beginning. A concern is the extent to which this teacher's professional health would be affected in the middle- and long-term if his apparent helplessness at negotiating this particular value difference was not overcome.

Could this feeling of frustration be similar to the plight of those immigrant teachers who had since left the teaching service in Victoria?

4.2.3 Factors Affording or Constraining Immigrant Teachers' Negotiation of Value Differences

The immigrant teachers' approaches to negotiating perceived value differences were adopted in the context of different levels of culture, such as the classroom, school, community, society and nation. These were seen to be either facilitating the immigrant teachers' attempts at negotiating the value differences, or impeding the success of such attempts. Given the constraints imposed by the questionnaire format, it was difficult to tell if some of these factors demonstrated the actions of competing, overriding, or second-hand values.

It was noted, however, that the nature of these factors (i.e. facilitating or impeding) generally differed according to the type of value difference perceived. Thus, the immigrant teachers' negotiation of differences in values relating to mathematics and to the teaching/learning of mathematics was generally accompanied by constraining contextual factors, be they institutional, societal or national in nature. One Indian immigrant teacher (questionnaire 30) wrote of the dilemma she faced, which was possibly rooted in the institutional culture she was in:

> My cultural ethos are not rejected, however, I am expected to accept local culture. (p. 9)

As for differences in values related to school mathematics as a subject, the teachers' response indicated generally positive support mechanisms existing at the level of schools (e.g. staff teamwork), education policies (e.g. differentiated mathematics subjects), and society in general (e.g. society's recognition of the role played by problem-solving). At the same time, constraining factors in this aspect of the teachers' practice tended to refer to education policies (e.g. closure of technical schools) and to the society. One such example was what a British immigrant teacher (questionnaire 7) considered to be a constraining factor arising from the 'praise culture' in Australia, although the Myanmar immigrant teacher mentioned earlier was clearly appreciative of this same culture:

> In some ways it has been harder [to respond to value differences] because there is a perceived need … to keep encouraging the pupils by telling them how brilliant they are in general terms while perhaps offering some small specific criticism. I can't help but feel this makes them think that they are performing well even when they aren't! (p. 10)

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The purpose of this chapter has been to provide a context for understanding the sources, destinations and some socialisation issues amongst immigrant teachers of secondary mathematics in Victoria. The state-wide survey has helped to provide such a sketch. While $\frac{1}{3}$ of immigrant teachers of secondary mathematics had come from UK, Malaysia and (North) America, $\frac{1}{3}$ of all immigrant teachers practising in secondary schools identified themselves with the Asian home culture. In terms of their professional destinations, it appeared that these teachers were more evenly distributed across schools in metropolitan Melbourne than elsewhere in the state, potentially creating an image of Melbourne schools as having the most multicultural mathematics teaching staff in Victoria. This phenomenon might be further accentuated by the observation (through the survey data) that more teachers from the home cultures of UK, New Zealand and America were teaching in country Victoria than in Melbourne.

Across all the home culture categories, more than half of the immigrant teachers were teaching in state schools, which may not be of any surprise. In particular, more teachers from Asia and Africa compared to the whole group of immigrant teachers were teaching in state schools. Also, immigrant teachers were more evenly distributed across state schools than schools elsewhere in Victoria. An interesting observation is that the proportion of immigrant teachers in individual schools was the lowest for Catholic schools. In fact, amongst teachers from the home culture categories of America, Europe, Middle East, and UK/New Zealand, there were at least as many teachers practising in independent schools as there were in Catholic ones.

As would be expected, nearly all immigrant teachers were teaching Year 7-10 mathematics, with a majority also teaching at least one VCE mathematics subject.

Perceived value differences amongst immigrant teachers surveyed were observed to be mostly related to culturally-different ways of valuing the school subject of mathematics, involving immigrant teachers across all categories of home culture. The data collected also seemed to validate the conceptualised range of teacher approaches to negotiating value differences, listed in Table 2.3. It was evident too that the teachers' approaches were targeted at the underlying values causing the dissonance, rather than at

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the forms of value differences. Not all value differences were successfully negotiated, however. One teacher reported feelings of frustration in his daily professional practice in the Australian mathematics classroom. While the teachers' attempts to negotiate value differences were reportedly not well supported by contextual factors, the category of value differences that occurred most frequently (i.e. school mathematics) was one to which immigrant teachers attributed positive facilitation at various levels of the Australian culture.

With this broad sketch of the situation of immigrant teachers of secondary mathematics in Victoria, let us move on to understanding the professional socialisation experiences of eight particular teacher participants in the next chapter, from the perspectives of values and of value differences related to different aspects of school mathematics teaching and learning.

CHAPTER 5

RESULTS FROM INDIVIDUAL TEACHERS' CASES

(The bell went and everyone was packing up, and the class chatter's volume was high)

Carla: (Answering a query from Rudi) You choose whichever you want to. It doesn't matter as long as you show the working and you get the answer.

(To the class) Right, excuse me, I haven't finished.

(Raising her voice when the class did not seem to have heard her) I haven't finished!

Give me a second.

(Shouting) Give me a second!

(Class volume continued to go up, and Carla gestured helplessly at one student)

One second. I want you to — Victor!

Student: Shhh!

Carla: Show me the respect. I'm here to teach you. You, like you!

(CL3: 264-277)

5.1 Introduction

The above incident represents an example in which a teacher (Carla) was visibly overwhelmed and helpless when confronted with a perceived value difference during one of her mathematics lessons. The context of the situation was not unique to Carla's classroom alone, and in fact this can be a rather common scene in schools when the bell signals the end of a lesson (whether the class teacher is a 'local' or an immigrant). What is unique and significant from the perspective of the current study was the teacher's interpretation of the situation as being a difference in the valuing of *power difference* in Australia and in her home country, Romania. Her repeated utterance of 'I haven't finished' was an indication of her valuing of the overriding *authority* of the teacher over the school bell, and over the students' intention to leave the class. The last line in the quote above further supports her valuing of teacher *authority* and the maintenance of a *power distance* between teacher and students. It also demonstrates her (re-)assertion of the teacher's authority to the class.

As we will encounter later in Section 5.3 and in its sub-sections, Carla responded to incidents of perceived power difference differently in different contexts. Such a response might be one of accommodating to student behaviour, when she believed that this

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behaviour had stemmed from a mistake she had made in class. In these instances, her valuing of (student) *confidence* and *self-esteem* was a powerful competing value that enabled Carla to accept the students' remarks, acknowledge her mistake, and apologise to the class. At other times, these values of *confidence* and *self-esteem* competed against Carla's valuing of *power distance*, and what resulted were episodes of attempts to ignore the incidents (e.g. CL3: 145-149), laughing it off (e.g. CL2: 174-181, 237-242; CL3: 100-105, 118-128, 174-183) and helplessness (e.g. CL3: 268-277). So, not only were teachers employing different approaches to perceived value differences (as we saw in the last chapter), but different contexts relating to the *same* set of conflicting values can also initiate these different approaches too.

This then is a snapshot of what this chapter will be focussing on. The last chapter had provided a general overview of the professional socialisation experiences of immigrant teachers of mathematics in secondary schools in Victoria. This chapter will focus on eight teacher participants so as to examine these experiences in greater detail, after a description of how these eight teacher participants were selected.

5.2 Selection of Teacher Participants

Of the 35 immigrant teachers who responded to the questionnaire, 9 had expressed willingness to participate in the in-depth component of this research study. Another 5 chose the option of 'not certain yet, you will keep me informed'. For these 5 teachers, follow-up telephone calls were subsequently made to them to explain the nature of participation in the research, and more importantly. to allow them to clarify queries. Eventually, 2 of them joined the initial 9 to form a pool of potential teacher participants for the next phase of the research. As introduced in Chapter 3, this phase was concerned with the collection of qualitative data arising from lesson observations, interviews, and document analyses. Eight of these teachers were eventually selected to be the teacher participants. The following pseudonyms were given to them:

Carla	Betty
Deanne	Khaliq
Li Kang	Manoj
Rana	Saka

The leading letter of these pseudonyms coincided with the leading letter of the respective teacher participants' real names, to facilitate my relating the pseudonyms to the actual

teacher participants themselves. Also, the ethnicity corresponding to each pseudonym matches the home culture of the teacher participant it refers to. Thus, for example, 'Manoj' is an Indian name which had been chosen for the teacher participant who indicated his home culture as (Fiji) Indian. These eight teacher participants had been selected to highlight a spread across teaching experiences (total, and Australian), years of residence in Australia, gender, home culture categories, and education systems of the schools they were practising in. Table 5.1 presents the distribution of the teacher participants across these factors.

For all the eight teacher participants, a preliminary conversation was held with each teacher, the same number of lessons were observed, they were interviewed the same number of times, and an equivalent amount of teacher-marked student assignments was examined. The collected data for all the eight teacher participants were analysed with equivalent rigor. However, for reason of word constraints imposed on this thesis report, the socialisation experiences of only four of the teacher participants will be presented in detail. The experiences of the other four teacher participants will only be summarised, based on the framework of analyses found useful and meaningful for the first four teacher participants.

Whilst it may be argued that the four teacher participants whose experiences will be reported in detail here could be selected at random from the eight, and while I could have done that, I had 'identified' these to be representative across the selected characteristics instead. Table 5.2 presents essentially the same information as Table 5.1, except that this information has been summarised further to demonstrate the distribution of the teacher participants more explicitly. As shown in Table 5.2, it is reasonable that Rana was selected since she was the only teacher participant practising in a Catholic education system. Also, Manoj was picked for being the only teacher participant with more than 29 years of teaching experience. Likewise, Carla's selection reflected her being the only teacher participant with less than ten years of teaching experience.

Table 5.1

Distribution of Teacher Participants across Selected Characteristics

| Teacher participant | Teaching experience (years) | | Years in Australia | Gender | Home culture category | Education system |
	Total	Australian				
Carla	6	5	6	F	Europe (excl UK)	state
Betty	11	9	9	F	UK	independent
Deanne	10	6	6	F	America	Independent
Khaliq	19	9	15	M	Middle East	state
Li Kang	27	12	12	M	Asia	state
Manoj	31	27	27	M	Asia	state
Rana	20	12	16	F	Asia	Catholic
Saka	18	1	3	M	Africa	independent

Table 5.2

Distribution of Teacher Participants across Selected Characteristics (Summarised)

	Teacher	Carla	Deanne	Betty	Saka	Khaliq	Rana	Li Kang	Manoj
Total years in teaching	0 — 9	✓							
	10 — 19		✓	✓	✓	✓			
	20 — 29						✓	✓	
	30 — 39								✓
Gender	male				✓	✓		✓	✓
	female	✓	✓	✓			✓		
Home culture category		Europe (excl UK)	America	UK	Africa	Middle East	Asia	Asia	Asia
Education system	state	✓				✓		✓	✓
	Catholic						✓		
	independent		✓	✓	✓				

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What was left was the choice of the fourth teacher participant from amongst the four teachers having between 10 to 19 years of teaching experience, namely, Deanne, Betty, Saka and Khaliq. None of the four home culture categories they represented (in order, America, UK, Africa, Middle East) was shared by the three selected te· ·cher participants, so this characteristic did not impact on the final choice. A desire for an equivalent number of male and female teachers narrowed the choice down to Deanne and Betty (after having selected Carla, Rana, and Manoj). Considering a similar desire in terms of the proportion of teaching experience in Australia over the total number of years in teaching, Deanne was finally selected as her proportion ($\frac{6}{10}$) was similar to Rana's ($\frac{12}{20}$) (that is, about $\frac{1}{2}$), and in contrast to those of Carla ($\frac{5}{6}$) and Manoj ($\frac{27}{31}$) (that is, nearly 1).

In the reporting of the teacher participants' experience with negotiating perceived value differences, each of the value differences will be labelled by an identifying term, which relates to a value that is emphasised to a different degree in the different mathematics educational cultures. This value may be valued more in the immigrant teacher's home culture, or valued more in the Australian culture. For example, *technology* and *mathematical proof* are labels for two of the value difference situations to be discussed for Carla. She had perceived that *technology* was more valued in her mathematics classes in Victoria, whereas the Romanian mathematics educational culture appeared to her to value *mathematical proof* more. On the other hand, the value used to label a value difference situation may refer to one of a pair of opposing values that are separately emphasised in the two cultures. An example of this would be Manoj's perception of *teacher-centredness* in Fiji and correspondingly, *student-centredness* in Victoria.

As the teacher participants' professional socialisation experiences are discussed, references to the relevant data source will also be made. There are two parts to each of these references. The first letter, making up the first part, identifies the teacher participant and is the leading alphabet of the teacher participant's pseudonym. The second part reveals the data source, and may be one of the following:

C	for preliminary conversation,
Q <item number>	for teacher questionnaire,
L <lesson number: transcript line number>	for observed lessons, and

P <interview session number: transcript line number>   for post-lesson interviews

Thus, for example, 'CP1: 308-315' would identify the data source as lines 308 – 315 in the first post-lesson interview conducted with Carla. Similarly, 'BC' would refer to the preliminary conversation conducted with Betty.

There will also be situations in this research report where particular teacher participant's voice will be given prominence through the inclusion of a relevant portion of her transcript. Relevant parts of the transcripts would be presented here in the same way that the sentences were uttered, so as to preserve the culturally-specific mood and language patterns against which the meanings of the utterances would be interpreted. Thus, in such quotes, omitted will be marked with '...', pauses and interrupted text with '_', and unclear words with '[word(s) unclear]'. Also, comments about context or tone of speech will be stated in brackets.

5.3   Carla

5.3.1   Introducing Carla

5.3.1.1   Personal Background

Carla is a female mathematics teacher who had immigrated to Australia from Romania (CQ1, 4). Initially trained as an engineer (CC), Carla had taught mathematics at both the primary and tertiary levels for a year in Romania, in addition to being a private tutor at students' homes. Carla made the move to Australia with her family in the mid-1990s. For three years she was teaching mathematics in schools in South Australia (1996 - 1998), and since 1999, there had also been three years of mathematics teaching in Victoria (CQ5).

Moving interstate to Victoria, Carla had initially settled in a country town near the Victoria - South Australia border. Having found life in the countryside not particularly suitable for her, she moved to metropolitan Melbourne in the first months of 2001 (CP1: 308 - 315).

Carla expressed her passion for mathematics explicitly. Her son's participation in an university mathematics enhancement program had provided Carla with another opportunity to be involved with the subject that excited her (CP3: 438-446). At the same time, she liked to teach (CP3: 358). Moving to a different culture in Australia, Carla felt

that she had adapted quickly in her professional practice (CP2: 52), thus suggesting that there had been one form or another of professional changes or modifications as a result of teaching in Australia. She did not believe that she would lose her 'old ways' of teaching, though.

There had been instances when her students would express their concerns with her teaching style (CQ29). This did not prompt Carla to overhaul her professional practice, for she believed that she was teaching effectively. These same students would often validate this belief later, asking if Carla could continue to teach them mathematics the following year. Carla also received similar acknowledgemeı t of her professional expertise from the students' parents (CQ28). In fact, when Carla's principal in her previous school did not approve of Carla's style of mathematics teaching, some of her students' parents had come forward to the principal to show their support for and confidence in Carla as their children's mathematics teacher (CC).

Carla was identified by her mathematics coordinator in the postal survey as being an immigrant teacher of mathematics. She responded to my invitation to participate in the teacher questionnaire exercise with interest, indicating that "it would be a pleasure" (CQ45).

That took place in late 2000, when Carla was teaching in a state secondary college in country, south-western Victoria. She was then in the second year of teaching in that school after arriving interstate from South Australia. The school was small in scale, with 250 students and some 30 teachers. 7% of these students were Aboriginals. The principal in that school did not approve of Carla's pedagogical approach, and he had been encouraging and reminding her to teach the 'local way'. The principal's weekly summons to her had, in her opinion, ironically made it harder for her to respond to value differences in mathematics teaching,

> by isolating me and my teaching manner from the rest. By remaiıding [sic] me all the time that I have a different background (like I wouldn't know that). (CQ42d)

Carla needed someone to share her professional concerns and issues with. Accepting my invitation to participate in the research study had not only provided Carla with a listening ear, that the study examined immigrant teachers' professional socialisation experience also meant that the listening ear would certainly be a very willing one.

Data of Carla's practice, however, were collected in 2001, when she had moved to metropolitan Melbourne to take up a teaching position in a state secondary college in January that year. Carla had interviewed successfully for a mathematics coordinator position in this current school, and the principal respected her pedagogical expertise and experience. Colleagues in this current school had also been appreciative of Carla's work in the school and department. Yet, as will be evident in the discussion of the value differences which Carla perceived, Carla had not been able to resolve all of these differences. Thus, in another way, participating in this research study was a source of emotional outlet for Carla. The following is a comment Carla made during my last interview conversation with her:

> I just love to teach. Look, I just don't have someone to talk to about this [that is, negotiating the perceived value differences]. Sometimes I think I have the feeling that I'm losing all these, all these - (CP3: 358-359)

5.3.1.2   Current School and Community Context

Carla participated in this research study during her first year of residing and teaching in metropolitan Melbourne. The school she was teaching in was a state coeducational secondary college situated in an inner-city suburb, where an increasingly graying local population meant that the number of school-age children in the local community was decreasing. Only slightly more than half of the school's 750 student places were filled in 2001. The 400 students had come from more than 50 different countries, demonstrating the direction the school was taking to remain operationally viable. As such, the school was an accredited provider of education for international students, and the school brochure emphasised that school life there was "enriched by a strong international perspective, one which values the harmonious diversity of cultures within the College". Two non-English languages were offered by the school in 2001. Also, it maintained sister-school relationships with a school in China, and the school principal's business card also featured a Chinese translation of her name.

At the time of working with me on this study, Carla still subscribed to the belief that the Australian community did not adequately value the experience and talent of immigrant teachers. She linked this to an incident in her previous school:

> What annoys me the most is that they don't try to talk to you as a person coming from somewhere, to see whether you know more or less, or better, or change ideas. This is what I sometimes don't understand. You know, ... when I was teaching in [my previous school] ..., they brought this person, this research guy from America. And they paid him quite well. Anyway, what he told us, the staff, there was nothing new. Like everybody was disappointed, not just me. In the end,

everybody was disappointed, and they thought, "why did they have this guy here?" I said to them, the administration. I said, "why do you have to pay so much money, why do you have to pay this person so much money, a person who comes from an educational system which we know doesn't work well." I mean, doesn't work, you know, we see what happens there. And I said, "when you have people like me here, and try to find out from me, like, you know very well the system in Europe works very well." The Asian system works very well. I said, "why don't you talk to people who are in Australia? You don't have to pay them that much. It's just so –" (CP3: 72-86)

I mean, it's not that I think our system is perfect, or where I came from is perfect. It's not perfect. There are weaknesses in the system as well. Why not share what's good? Why not? And usually, they are not interested in how you think as a person. (CP3: 114-117)

However, Carla felt that her current colleagues had accepted her socially. Although colleagues generally perceived her as being strict, and as one who drove students to work hard, these colleagues also acknowledged that the school really needed more teachers like Carla to lift its standards further (CC).

5.3.1.3   Personal Values and Beliefs

I strongly believe that Maths is Maths in any culture. I teach Maths my own way, with a great passion and commitment to the students I teach. (CQ comments)

As is evident in the quote above, Carla valued (school) mathematics as being *culture-free*. That is, whilst the context for questions and whilst notations may differ amongst cultures, the mathematics involved remains the same. This may explain why Carla did not appear to be bothered by a student's use of the French decimal notation in the evaluated answers (see Figure 5.1), one which uses the comma instead of the period to denote the decimal point. At the same time, it also helps us to understand her nomination of 'personal values' as the most influencing set of values in her daily-life values portrayal (CQ40, 41). In terms of her classroom practice, this valuing of the culture-free nature of mathematics had resulted in her introduction of solution methods that were seldom seen in the Australian curriculum. During one of the lessons observed, Carla introduced a geometric method for a question, challenging students' recall of related geometric facts as she went along:

(The question being tackled was: Given a regular hexagon ABCDEF with centre O and sides 1.5cm each, show that OA = 1.5cm)

Carla: (After going through a solution whose approach was suggested by some students)

Now, there are other ways of showing that this is 1.5m. Can you see another way? Can you see another way of showing this is 1.5m? What can you tell me about this line and this line here?

Student: They are parallel.

Carla: They are parallel. These two are parallel. What happen to these two?

Student: Parallel.

Student: There are three lines which are parallel, that one, that one, and this.

Carla: This one, this one, this one. Anyway, let's just not being so, this is parallel to that, this is parallel to that, this is equal to that. Now, what kind of shape is this one?

Student: Parallelogram.

Student: Rhombus.

Carla: That's a rhombus, isn't it? What do you know about the sides of a rhombus?

Student: It's the same.

Carla: They're the same, isn't it? So if this one is 1.5m, these two are 1.5m.

Student: That's easy.

Carla: So, there isn't one single way. (CL3: 1-32)

This took place in a Year 12 Further Mathematics class, and none of the students appeared to be put off by the introduction of an apparently novel (geometric) approach in

their final year of secondary schooling, at the end of which they had to sit for a high-stakes state examinations. In fact, the comment given by a student (given towards the end of the quote above) appeared to suggest the contrary. Such positive response from students was reaffirming for Carla (CP3: 27-30). Carla further reasoned that exposing students to different methods of solving mathematical problems could foster student confidence in doing mathematics (CP2: 5-13), and develop student interest in the subject (CP3: 27-32). After all, sharing of alternative methods was a way of explaining related concepts too (CP3: 66-71), so Carla felt that the extra time needed to do that was worth it (CP3: 56-65).

This valuing of mathematics as being *culture-free* was probably why Carla felt that the values she portrayed as a teacher would be independent of the country or culture she was teaching in (CQ33). These would have accounted for the observation that her preferred teaching style, her teaching style in Australia, and her teaching style in Romania were all identical (CQ35-37). In particular, Carla's teaching style (preferred, in Australia, and in Romania) emphasised *direct instruction, drills*, and *problem-solving*. The extent to which her professional practice carried these activities through, though, did not need to be similar across the three contexts. For example, the number of drills exercise questions Carla put her students through was less in Australia compared to her teaching days in Romania.

This knowledge allows us to understand her when she claimed that

I had adapt [sic] of course to the different conditions. Whenever I teach I try to raise the standards of Maths. (CQ42c)

The word 'adapt' was likely not used here to indicate that she had modified aspects of her teaching repertoire in the context of the Australian culture. Rather, while the teaching styles remained unchanged, the extent to which these were demonstrated was 'adapted' to the local conditions, such as the number of drills questions given to students. Adaptation could also be in the form of artificially 'altering the external façade' only. For example, if the furniture in a classroom were found to be arranged in such a way as to facilitate student group-discussions, Carla would not make any change to that arrangement, but she would still continue to teach with a direct instruction style even though the students might be sitting in groups (CC).

5.3.2   Nature of and Responses to Perceived Value Differences

5.3.2.1   Mathematical Proof (Mathematics Educational)

One of the more significant value differences perceived by Carla in the mathematics classroom was related to the demonstration of mathematical proofs in mathematics teaching. As such, this perceived value difference has been labelled *mathematical proof*.

As Carla recalled, in Romania,

> we need to have demonstrations; this is what we call proof [in Australia]. Everything was proved, not just "this is the formula, this is how you do it." It was all proof. (CP1: 47)

Carla's observation of mathematics teaching/learning in Australia was one of simply giving students the relevant formulae (CP1: 34, 57; CP3: 333-334). Even for those teachers in Australia who led students to conduct investigations to 'derive' the particular formula, she felt that the subject would still be trivialised somewhat:

> what I don't understand, I might be wrong, ... [is that] all these mathematicians worked years and years and years to develop theorems, and we want the kids to follow some steps to work out the formula at the end. I find that stupid. I can't see the point in there .... Because, not everybody has mathematical thinking. Plus you don't have the instruments. If you haven't got the time to work on it, like they used to work 24 hours a day, everyday, they were thinking of this, and we want the kids to actually work out the formula. (CP3: 273-297)

In her opinion, the ways in Australia with which formulae were introduced compromised student understanding (CP1: 58), and in turn, student interest in the subject (CP1: 57). In fact, Carla believed that everything in mathematics needed to be proven (CP1: 32, 34, 56).

So, Carla was observed showing, explaining to, or discussing with her students proofs of concepts introduced in her lessons. A quick explanation of the related proof, for example, enabled her to demonstrate to the class why the tangent of an angle is a ratio of the opposite to the adjacent sides corresponding to that angle (CL1: 77-104). Her enthusiasm for proofs could be discerned from the way she concluded the discussion, that is,

> so, is that interesting? (CL1: 104)

Carla had also given another example of her sharing of proofs with students:

> when you have the quadratic formula, I always like to actually go through the working out, how you get to the formula, not just give the formula on the board. I like to explain what's behind these formulae. (CP1: 33-34)

Carla evidently felt supported in her responses to this value difference by the positive feedback made by her students (e.g. CP1: 28-30, 35, 54-55, 75-76):

> Like the kids today, when someone says, "oh, that's good" or "oh, gee!", it gives you something like, you know, you can enjoy this! And they were something very simple, you know, but they were something they haven't seen before. And, they understand now that how come that was that. (CP1: 75-76)

5.3.2.2   Participation (Mathematics Educational)

Carla had noticed that whereas students in Romania were eager to answer posed questions and always had their hands raised, students in Australia did not appear as eager in these situations (CP1: 84-89). Carla's interpretation was that students in Australia tended to be more conscious of themselves, so that they preferred not to raise their hands in class.

For this reason, Carla typically did not pick students to answer the questions she posed during her practice in Australia. Many such examples were evident in the lessons observed (e.g. CL1: 24-30, 63-66, 77-99; CL2: 18-23, 36-62, 69-75, 94-97, 100-102, 183-185; CL3: 5-7, 9-11, 17-21, 84-87, 138-142, 168-170, 213-216). On the other hand, that Carla did not believe in straight exposition of content had meant that questions were still posed in her lessons in Australia. In her Australian class, however, any student could offer an answer or opinion from his/her seat, without the expectation to raise the hand first. After all, as Carla said in a post-lesson conversation, picking students to answer questions might end up embarassing them (CP1: 94).

There were a few instances during the lessons observed, however, when Carla did identify particular students to answer questions (e.g. CL2: 153-157; CL3: 56-59). This was confirmed by Carla later to have occurred in some other lessons as well (CP1: 98-99, 112). In such instances, Carla would normally pick students who were normally quiet in class

> because I want to know what they know, or if they get the understanding or not, or usually the quietest kids wouldn't tell you themselves. (CP1: 113)

This approach to picking students in class was also adopted in Carla's teaching in Romania (CP1: 117-118). Posing questions to evaluate student learning was probably the source of discomfort amongst Carla's students in Australia.

Incidentally, Carla made it a point to attempt to put students at ease when they answered the questions wrongly, emphasising that what was more important was the learning achieved in the process rather than the correctness of answers offered (CP1: 98):

> if they come with the wrong answer, I tend to say, "doesn't matter, we all make mistakes. So what's the big deal?" You know, I mean, you have attempted this. (CP1: 102)

5.3.2.3 Computational Fluency (Mathematics Educational)

Carla continually placed a great deal of emphasis on students' *fluency* in computation. In her opinion, Romanian education stressed more on (mental/paper-and-pencil) *computational skills* (CQ18), and she felt that the Australian teachers' emphases on *understanding* and *applications* had led to what she called 'basic knowledge gaps' (CP1: 207), that is, gaps in the body of basic knowledge. She cited an example of such a 'basic knowledge gap' relating to cross-multiplication amongst her Years 11 and 12 students:

Carla: I have noticed that nobody teaches it [cross-multiplication] here. If you have — can I show you?

Interviewer: Um.

Carla: If you have two fractions, right, a over b equals c over d, alright? Let's suppose I want to find out this one when I know these ones, alright? The easiest way to go is times this, and divide by that. Or, if you want to find this one, you times [showed working on paper]. It's not taught here. It is not taught, not, how do you work this out if it is not taught [laughed]. It's not taught. You look, you look in the syllabus, it is not there! You know, it's not there! Or, cross-multiply ....

Interviewer: It's not taught, yeah.

Carla: It is there, but, but, it's not taught, you know.

Interviewer: This is a big problem for a lot of them, even in Year 12 ....

Carla: This is what I taught them a couple of weeks ago, you know, a equals bc over d, that's it, what's c? Oh, ad over b, you know. And they just liked it. And I did the same thing with my Year 11 Physics, because you need this so often. And they said, they said to me, "but nobody has taught this," you know? I said, "I know, it's not there." And it isn't, you know? I mean, how do you want students to understand half the things when something like that is, doesn't _ you know you have things like a over b, you know, over c over d. I had to explain that. You know why, because the lesson before I had this [wrote down equation], alright? The lesson before I had this, and they couldn't work out why I did _ that [worked it out]. (CP1: 212-236)

In Carla's opinion, teaching with an investigative approach would not have reflected the spirit of the mathematics discipline:

> And, what I don't understand is some people do here, they don't teach a thing. They start with an investigation, from the investigation you work out the answer. What I don't understand, I might be wrong, but I might be wrong, Wee [Tiong], all these mathematicians worked years and years and years to develop theorems, and we want the kids to follow some steps to work out the formula at the end. I find that stupid. I can't see the point in there. (CP3: 271-276)

In response to this perceived difference in valuing of *computational fluency*, Carla would teach the necessary skills that students lacked, and which would assist them in solving the current problem or understanding the current topic (CP1: 212). In this regard, Carla put her students in Australia through drills exercise, although it must also be mentioned that typically less questions than she used to give out to her students in Romania were given out in her Australian classes (CQ25). Nevertheless, students still tried to 'bargain' with Carla:

> Oh, I do that [drills] all the time. These kids, these Year 12s you've seen, they've done every question in the book. Every single one, and I've got plenty for every chapter. I never say, "do the left hand side or do the right hand side." No, all of them! "You know, but so-and-so said, last year's teacher said, "do the left hand side!" I say, "good, I'm saying do the left hand side then the right hand side!" Sometimes they ask me, "do the left hand side?" I said, "yeah, do the left hand side, and then when you've finished, do the right hand side!" I always do that, because it's important. I sometimes do with the younger kids, I do things with the whole class, and I ask them until they know how to. (CP3: 408-418)

In her opinion, drills is a necessary part of mathematics education, and students' competency in computational skills would actually facilitate their ability to solve the kind of applications and analysis problems they would encounter in the education system, including the standardised state tertiary-entry examinations, the VCE. Her teaching style in Romania was similar, reflecting her values in this aspect of mathematics education (CQ43):

> Carla: I prefer the drills.
>
> Interviewer: But we are also aware that we have constraints like SAC [school-assessed coursework] -
>
> Carla: See, I like drills. Once they know what to do, I love to do something like I did today. But when they know what they are talking about. But if they don't know what they are talking about, I don't like to do that type of thing, if they have no idea of the content .... I never. I am never going to give up on drills because this is how it works. (CP3: 395-402, 426)

These 'fixing-the-leaks' measures did not appear to be something Carla enjoyed doing in her professional practice:

> sometimes I would love them to know their basics, so that I don't have to go back and do something special, you know, something extra. I would love them to come to class and, um, I teach the lesson and they go from there. I don't have to [word unclear] the schedule. I would love to do something like that. (CP1: 298)

Her efforts to teach 'basic skills' to students were, however, welcomed by students,

> and they just liked it. And I did the same thing with my Year 11 Physics, because you need this [mathematical skill] so often. And they said, they said to me, "but nobody has taught this," you know? I said, "I know, it's not there." (CP1: 231-233)

As with some other value differences Carla perceived, it was this kind of student validation of her pedagogical decisions which had helped her maintain some sense of professional confidence.

Carla's valuing of mathematics as *culture-free* and her valuing of *computational fluency* were likely to explain her apparent emphasis on student mathematical concepts without much regard to their literal expressions. For example, one of her Year 9 test questions asked students to "explain, with the help of a diagram, the following mathematical terms", the terms being 'angle of elevation' and 'angle of depression'. An examination of Carla's marking revealed that full marks were awarded to students as long as they could demonstrate the relevant angles in the diagrams. Looking at where the tick marks were positioned, the students' literal explanations were not seen to be important, even if these explanations were not precise (e.g. Figures 5.2a-c), or were absent (e.g. Figure 5.3). In fact, as Figure 5.3 demonstrates, use of language was not a factor at all in securing full scores in that question (CA4).

Figure 5.2a. Full marks awarded for student diagrams, even when the language used was not precise.
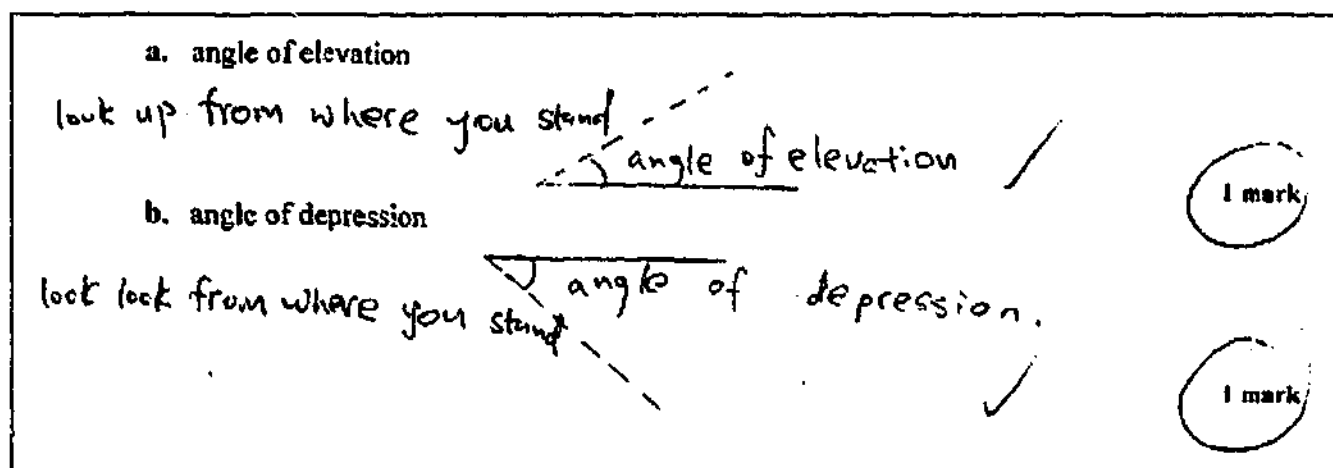
Figure 5.2b. Full marks awarded for student diagrams, even when the language used was not precise.

a. angle of elevation

∠θ angle of elevation The angle of view you are seeing from the bottom to the top. *(1 mark)*

b. angle of depression

θ angle of depression. The opposite of angle of elevation *(1 mark)*
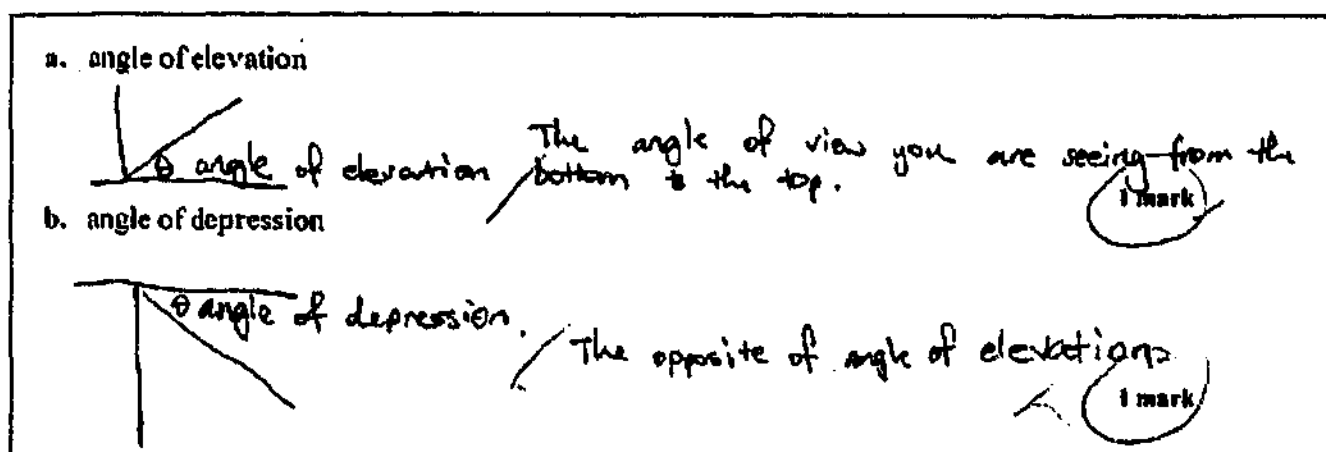
Figure 5.2c. Marks awarded for student diagrams, even when the language used was not precise.

7. Explain, with the help of a diagram, the following mathematical terms:
a. (angle of elevation) where the line of the angle lifts up *(1 mark)*
b. (angle of depression) where the line on the angle goes down *(½) (1 mark)*
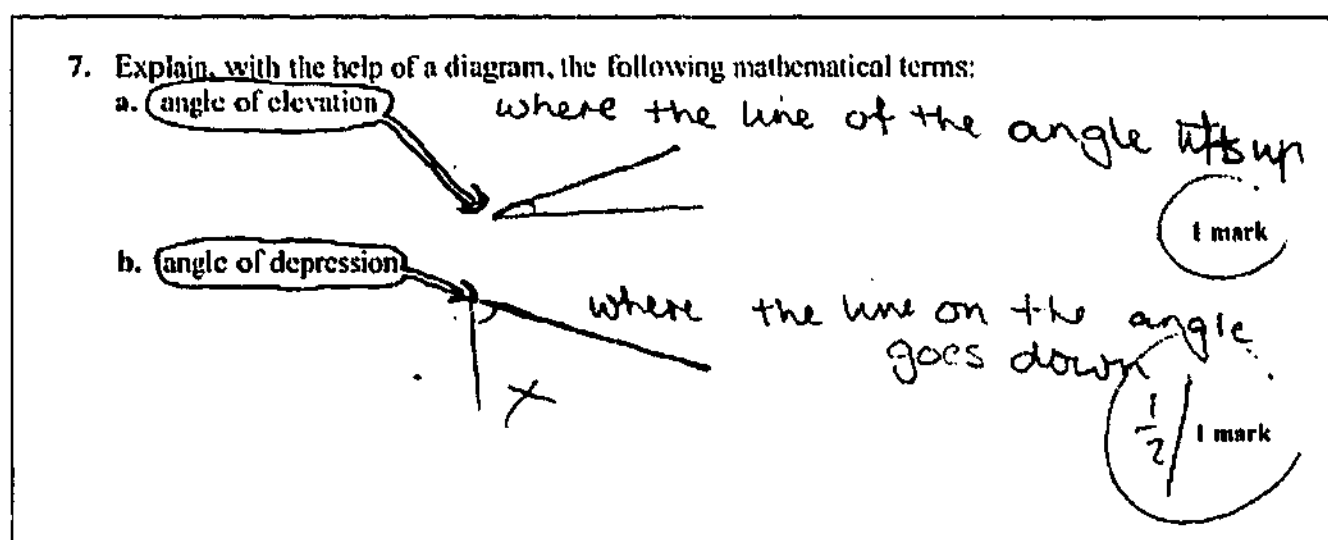
Figure 5.3. Full marks awarded for diagram only.

7. Explain, with the help of a diagram, the following mathematical terms:
a. angle of elevation *(1 mark)*
b. angle of depression *(1 mark)*
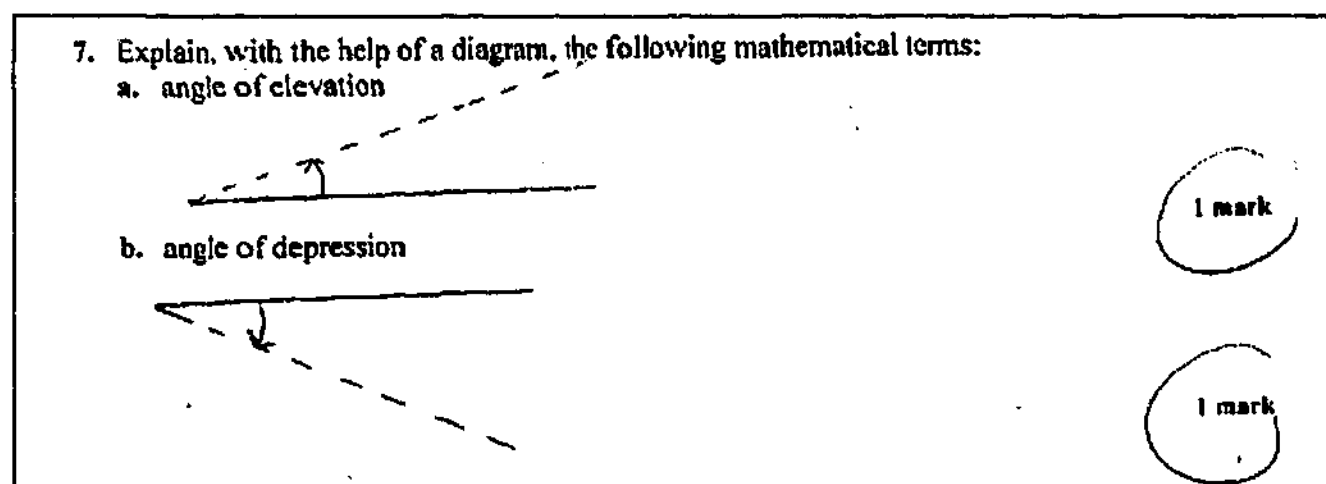
5.3.2.4   Technology (Mathematics Educational)

Carla's personal fluency in mathematical computation was cultivated without the assistance of technological tools like calculators. In fact, her first encounter with calculators in her education was at university:

> I remember that we had to use calculators at university in one subject, because we were working with so many decimals and it was just, we were talking about structures of buildings and materials, and you need it, you need it at that point. It was second year at the university, I remember that it was the only subject that we were required to have a calculator, because it'd have taken us too long to solve a question. It was the only reason, just to be faster. We weren't allowed to use calculators at high school. We were not allowed. We could purchase one, but we weren't allowed, because you just imagine we used to do multiplication, division, square root by hand. (CP3: 122-131)

Her proficiency with 'paper-and-pencil' computation is evident in the following remark:

> for simple numbers, by the time I grab the calculator, and I push the numbers on the calculator, I do it by hand. (CP3: 133-134)

Thus, in Carla's view, calculator use did not present any learning advantage for students:

> It's not an advantage. I don't think it's an advantage. First of all, because it stops them [i.e. students] from thinking. Like, when you get to the point where you grab the calculator to do 10 divided by 2, that's useless. Secondly, if they don't know, you know what some people do? For example, you have something like 2 divided by 5. It's a fraction, right, at the numerator you have 2, at the denominator you have 5 times 10 to the power of 3 [i.e. $\frac{2}{5 \times 10^3}$], let's say. What they do in the calculator, they do 2 divided by 5 times 10 to the power of 3, which is a totally different, now, if you don't know how to use it, and I always say, "put the brackets, like that," or "2 divided 5 divided by 10 to the power of 3, because you divide this by both." So if they haven't got the understanding of what's behind the calculation, of course they get shocking answers sometimes, because they don't know how to use the calculators. But, once you, like if they knew this, if they knew what was happening here, they didn't need me to tell them how to put it on the calculator. But because they don't know how to use it, they've got no idea what the mistake was. It was they who made the mistake, you know. And this happens in Year 12, Year 11. So I can't see the point in using the calculators. First of all, they forget their times tables. The brain is not working. Like you go into the shop, you're not going to go with a calculator in your hand, and calculate 50% of something, or which one is better, is cheaper, to buy 200ml of this juice at 1.6 dollars, or 235ml of this at this price, you know. I mean, you need to know how to do these things. (CP3: 139-160)

Yet, the school mathematics curriculum in Victoria promoted the use of information and communication technology (ICT). For example, questions in the high-stakes, tertiary entrance examinations (VCE) were no longer graphic calculator neutral. In response to this difference in the valuing of *technology*, Carla could only discourage her students against being reliant on calculators for simple computation questions. At the same time, Carla provided the appropriate modelling in class. For instance, during one of the lessons observed, a student had suggested using a calculator to find the value of a square root.

Carla replied that the calculator was not necessary as the square root could be computed mentally (CL3: 36-42), which she demonstrated. Her modelling was also extended to easier computations, such as multiplication:

Carla: Equals six times area of triangle AOB, equals six times 0.974, equals (calculating mentally) 5.844?

Student: Human calculator! (CL3: 89-92)

As with the other value differences she perceived, Carla's approach to negotiate the difference in valuing of *technology* was validated by her students' positive responses. For example, the student in the quote above was evidently visibly impressed by Carla's ability which paralleled that of the calculator.

5.3.2.5 Power Distance (General Educational)

Differences in the nature of teacher-student relationship in Australian and Romanian classrooms highlighted further value differences in the two cultures. Carla's experience teaching in Romania was one in which the teacher was seen to be perfect, where the teacher was not expected to make any mistake (CP1: 158). Students in Romania would also not try to uncover teachers' mistakes in public (CP1: 146-152). While teaching in Australia, however, Carla came across many situations where her students would 'talk back', challenge her, and/or act rudely. Some of these were also observed in the lessons observed (e.g. CL1: 153, 192-208; CL2:174-177, 237-240; CL3: 71-75, 100-102, 122-125, 144-147, 174-179). The following provides such an example:

Carla: What I'm going to do, at the top of the page, write this.

(Wrote the following on the board: 'Calculator: Degrees')

Would you please write this, because you will forget again. At the top of the page, just make sure that you write this, so you know it. It does happen, I mean, it happens to everyone. It's not a big ….

Student: Including you?

Carla: It does, when I have the answer, then I think, "oh, I forgot to change it."

Class: Tsk tsk tsk.

Carla: Because when you use your calculator, what you want to do, you want to work out the answer, right? So, you punch your numbers, and then when you see the answer ….

Student: Press; punch is not good for the calculator. (CL1: 192-208)

In her first days of teaching in Australia, Carla would interpret such student comments

as a challenge to (her) authority, and she did not like any of these at all.

> I didn't like it. I thought this is not right, you know, I mean. But it's, you know, I sort of realise where it comes from and why it is, it doesn't worry me anymore. (CP1: 175-176)

Although she still believed that students should treat teachers with greater respect, such incidents no longer bothered Carla as much. She had become more comfortable with admitting any mistake she made in class:

> when I'm wrong, when I do something wrong, I said, "I made a mistake." When I do something right, then that's just the right way, because I'm very honest. I make a mistake, I admit it. So what, we all make mistakes. (CP3: 240-242)

Thus, Carla was observed to be acknowledging — and apologising for — the errors she made (e.g. CL1: 195-210; CP1: 157; CL3: 71-76, 174-177; CP3: 240-242). Through her experience, Carla believed that teacher admission of own mistakes could also discourage students from continuing to pick on the teacher (CP1: 186-189). Also, in her opinion, student picking on teachers was a reflection of their lack of confidence (e.g. CP1: 156, 159). Understanding Carla's concern with raising/maintaining student confidence in themselves (e.g. CP2: 5-13, 30-31; CP3: 216-218), it probably contributed to Carla's tolerance with Australian students' behaviour when she made mistakes.

However, when student remarks made were not in response to any teacher mistake and students were just being rude, Carla appeared to be helpless. In each of these instances, she would either ignore the incident (e.g. CL3: 145-149), laugh it off (e.g. CL2: 174-181, 237-242; CL3: 100-105, 118-128, 174-183), or simply give up (e.g. CL3: 268-277). For her, appearing to ignore the incident or to laugh it off was not a negotiation approach; she did not know how else to react, and she was still visibly affected by these incidents. This is illustrated by her comments after a lesson in which a student complained that she had messed up his mathematics notes:

> I was so disappointed with Dino. I was quite upset .... Like I did get very upset when Dino had that go at me, "oh, you don't know how to, you messed up the question," and I thought, "can't you just say what happened." (CP3: 39, 237-239)

Referring to a separate incident in class, Carla's exasperation was rather evident:

> Even, sometimes, see, even today in class. I look at the boy and I think, "this is getting so much," letting me down. It's hectic to follow. (CP3: 364-366)

Thus, Carla still subscribed to the valuing of a *power distance* between teacher and students. The prevalent use of imperatives whenever Carla issued instructions to her class (e.g. CL1: 236-238; CL2: 36, 115, 187, 237-238; CL3: 239, 246-247, 278) lent support to

this assertion. This maintenance of a distance between teacher and students could also be noticed in Carla's marking. As shown in Figures 5.4 and 5.5, students' written comments and apologies (clearly addressed to her) appeared to have been ignored while Carla's marking emphasised the mathematical aspect of student work. Any written acknowledgement of these student comments by Carla would have signalled a less formal relationship between her and the student involved. Her sense of helplessness in the face of students' 'rude' remarks was in line with her valuing of *power distance*. However, her concern with student *confidence*, and her belief that she needed to apologise for mistakes made anyway, illustrate the competition between *power distance* and other values such as (student) *confidence*.

Figure 5.4. Full marks awarded based on diagram only; student's comments appeared to have been ignored.
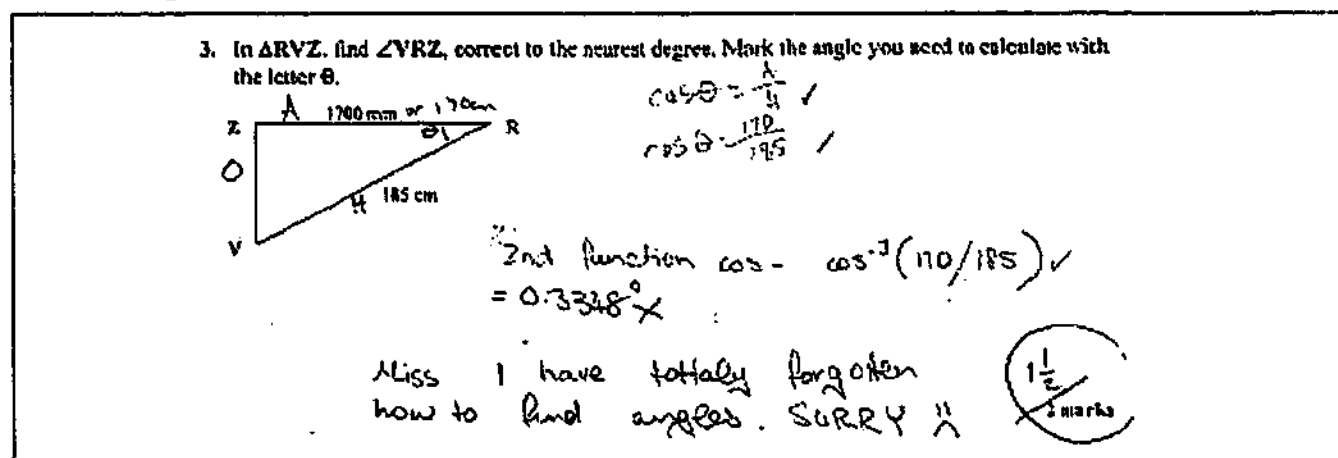
Figure 5.5. Another example of student's comments being ignored.
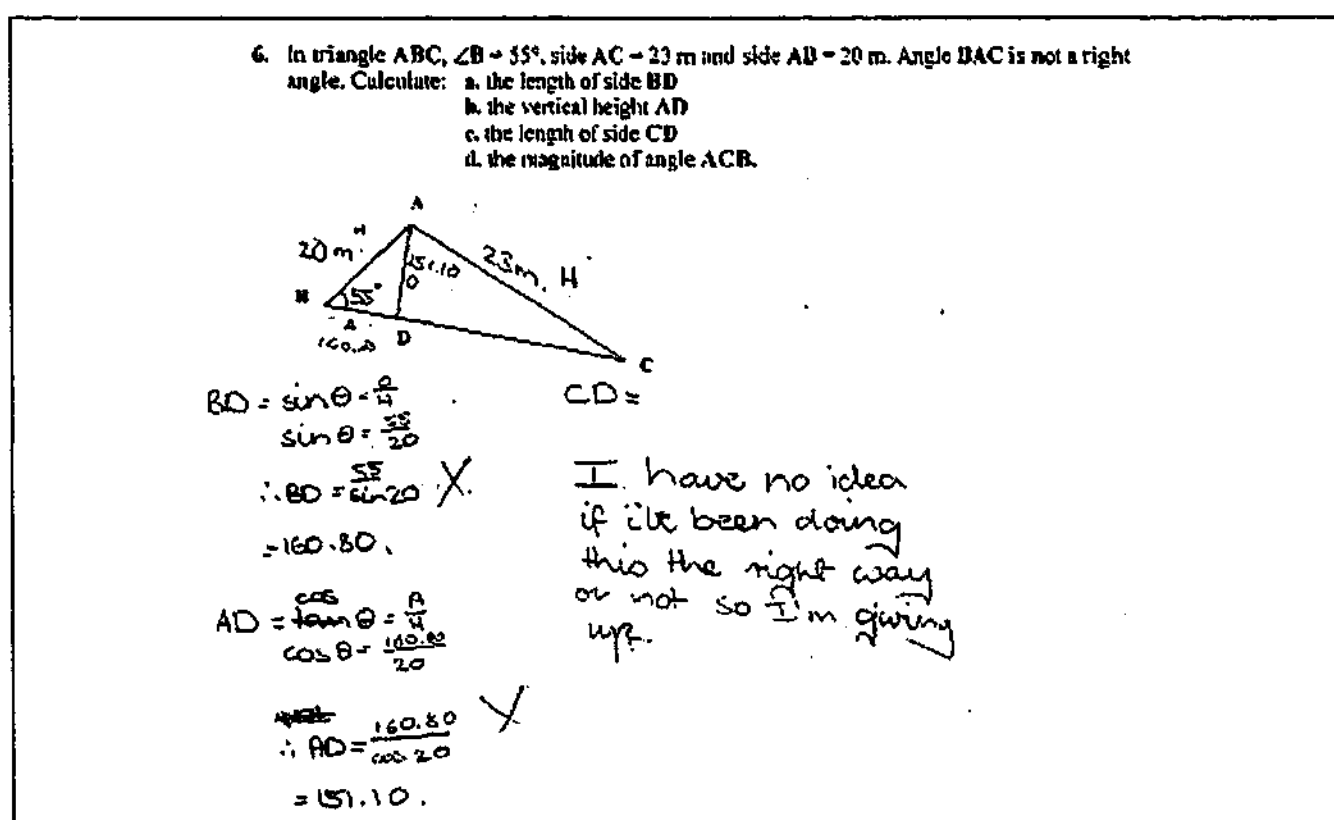
5.3.3 Responsive Approaches and the Underlying Factors

It is clear from the discussion above that Carla negotiated perceived value differences with a range of different approaches. This should not be seen to represent inconsistent assumptions on her part towards mathematics teaching/learning, or towards professional socialisation. Rather, it was likely that the different institutional and societal factors interacted with personal, culturally-based values, resulting in constraints or opportunities in Carla's attempts to negotiate the value differences. It was also apparent that Carla's valuing of mathematics as a culture-free subject had played an important role in ensuring that none of the values related to mathematics and mathematics teaching/learning which she cultivated in Romania was lost in the process. The one value difference (*power distance*) which saw Carla embracing local practices was neither mathematical nor mathematics educational in nature.

It was perhaps this notion that mathematics (and mathematics teaching/learning) was culture-free that led Carla to attribute perceived value differences to the people involved in such incidents. It was evident in Carla's conversational discourse of her adopting a 'I/us' (Carla, and by extension, fellow immigrant teachers) versus 'them' (the Australians) stance (e.g. CP3: 66-74, 214-215). This is illustrated through statements such as the following:

> What I have noticed, I don't know if you've noticed this or not, but underneath the educational system these days, here in Australia, there is this idea, you know, talk to the kids and develop skills, whatever. Like the idea is there, but the practice is not. *They* don't know how to do it. *They* always talk about make things interesting, develop *their* understanding. But *they* don't know how to do it.

> What annoys me the most is that *they* don't try to talk to you as a person coming from somewhere, to see whether you know more or less, or better, or change ideas. This is what I sometimes don't understand. (CP3: 66-74, emphases added)

While Carla valued student *participation* during mathematics lessons, her concern for student *confidence* and *self-esteem* meant that there were times when she would hold herself back from picking particular students to answer questions in class. In regard to technology use, she was explicitly promoting mental computations of square roots during her lessons, yet she was also aware that institutional and societal factors (such as preparing students for the VCE) meant that student calculator use had to be allowed. Similarly, while Carla strived to improve students' *computational fluency* by putting her

students through drills exercises, she was mindful that local factors restricted the number of questions she could reasonably expect her students to do.

In these instances, Carla's practice in her Australian class reflected a fusion of what she valued and the institutional/societal factors. While she valued aspects of her home culture's educational system (such as paper-and-pencil *computation*), Carla also acknowledged that these needed to interact with local values, norms and practices such as student confidence and institutional assessment requirements. By the nature of interaction (Bishop, 2002) of values, it is likely that no one cultural value consistently dominated a competing value from the other culture. Nor was there a need for such a certainty as Carla attempted to reflect a balance of her concerns in different contexts at different times. That is, despite attributing a label (i.e. appropriation) to Carla's approach to negotiating, say, the cultures' different emphases on *technology*, the extent to which Carla would explicitly encourage her students to rely on paper-and-pencil computations would depend on the extent to which the particular group of students were thought to be over-reliant on calculators, or the extent to which they could use these tools efficiently.

As for her perceived difference in the cultures' valuing of *proof*, however, the apparent absence of institutional/societal constraints had probably led Carla to act in ways which would be best described as being culture-blind (using the terminology of the approaches summarised in Table 2.3).

Carla had not been able to resolve all the value differences she perceived in her Australian mathematics classroom though. The emphasis she placed on teacher *authority* and *power distance* had meant that she could remain helpless and exasperated whenever she interpreted particular student actions to be rude, of which the opening quote of this chapter is an example. On the other hand, in instances when she recognised that these behaviours were justified by a mistake she had made, she was ready to accommodate and accept them willingly. Thus, as mentioned at the beginning of this chapter, different contexts pertaining to the same perceived value difference (in this case, *power distance*) could bring about different meanings to what was or was not valued, thereby prompting different negotiation approaches.

Carla was certainly aware that the nature of interpersonal communication in Australia was much less hierarchical than in Romania, and that she could not expect here the same level of respect Romanian students accorded to teachers. Yet, her upbringing in Romania

has also meant that she could not help feeling a sense of hostility and disrespect in situations when students were perceived to be speaking rudely to her. As we had seen earlier, her use of imperatives represented her attempts to (re-)establish a power difference between herself as teacher and the students in the class. Nevertheless, she would still leave a class feeling exasperated and disappointed. Thus, to the extent that Carla could resolve her perception of hostility and conflict whenever her students' actions appeared unreasonable, it is likely that this value difference would remain a source of professional dissatisfaction for Carla.

The discussion in Section 5.3.2 (and its sub-sections) above has also shown how much Carla relied on the feedback from her colleagues, students and their parents to affirm her approaches to negotiate the perceived value differences. For her (and possibly for many other immigrant teachers of mathematics), positive feedback from these 'locals' appeared to validate her particular ways of teaching mathematics, ways which incorporated aspects that reflected values subscribed to in her home culture.

Before moving on to a description of the professional socialisation experience of the next teacher participant, Table 5.3 summarises Carla's experience negotiating those perceived value differences which were evident during the data collection phase of this study. For each of the value differences perceived, its nature (mathematical, mathematics educational, or general educational), Carla's responsive approach, and the operating facilitating or constraining factors are listed. Contextual factors that reflected what were valued in a teacher's home culture would be considered to be facilitating the teacher to portray the associated values, and are denoted by the sign '+' in the matrix. On the other hand, contextual factors that were aligned with Australian values would be constraining a teacher's continual portrayal of values she acquired in her home culture, and are denoted by the sign '−' in the matrix. The construction of one such matrix for each teacher participant would facilitate future comparison of their respective experiences.

Table 5.3

Value Difference Matrix for Carla

Value difference	Nature [a]	Responsive approach	Contextual factors [b]
Proof	ME	Culture-blind	(+) Personal education in proofs.
			(+) Positive student feedback.
Power distance	GE	Accommodation or Nil (helpless)	(+) Personal upbringing which emphasises respecting authority.
			(–) Student confidence
			(–) Admission of personal mistakes.
Participation	ME	Appropriation	(–) Student confidence.
			(+) Evaluation
Computational fluency	ME	Appropriation	(+) Personal upbringing in mathematics solving skills.
			(+) 'Basic knowledge gaps' amongst VCE students.
			(+) Positive student response.
			(–) Availability of student time for homework practice.
Technology	ME	Appropriation	(+) Personal proficiency in mathematics.
			(+) Positive student feedback.
			(+) Student over-reliance, even for simple computations.
			(+) Student knowledge of calculator use
			(+) Calculators not readily available in daily life.
			(–) School curriculum requirement for technology.

Note. [a] The nature of value difference may be:

      mathematical (M),

      mathematics educational (ME),

      general educational (GE).

[b] Contextual factors may be:

      facilitating (+), aligned with the home culture value,

      constraining (–), aligned with the Australian value.

5.4 Deanne

5.4.1 Introducing Deanne

5.4.1.1 Personal Background

Deanne is an immigrant teacher from Toronto, Canada. At the time of participating in this research study, she had been in Australia for 6 years.

After Deanne graduated from teacher training school in 1991, she spent the next 4 years teaching in a public secondary school in inner city Toronto. The school, with a student population of 900, was considered a big one there, and Deanne characterised it as a 'rough' school, with high incidences of crime and gun-carrying. Most of the students in the school were East and West Indians, many of them new immigrants to Canada. There was 'automatic respect' for teachers from these students, typical of the respect accorded to teachers by the community there. Deanne remembered noticing that some parents were feeling a bit apprehensive about teachers. In fact, her school in Canada had attempted to put parents at ease through different means, one of which was to encourage teachers to dress casually during parent-teacher meetings.

The school's curriculum time was slightly longer in Canada: a typical school day would begin at 8.45am and end at 3.45pm. (DP1: 184). Students were normally given classwork in a typical Canadian mathematics lesson, so that they would be able to complete any homework issued (DN1).

Deanne felt that much of her professional values were internalised in the school she taught in Canada. She noted how her older colleagues there might have influenced her outlook on mathematics teaching:

> I can think of a colleague that I worked with who is very much sticking to notations and — but she's been teaching maths for a long time, whereas people perhaps are not interested to know whether that same formality exist in teachers that are just starting. Because even when I taught in Canada, I was the first person to be hired to the maths department in 10 years, and everybody I worked with was 50 years plus. So very much of it was that 'old school' formula, and I think that's what, they were my mentors, and I sort of grew up in that situation there. (DP1: 104-110)

During her first year of teaching in Canada, Deanne wedded an Australian man. Four years later, in 1995, the couple shifted to the current community in country Victoria, where Deanne had applied successfully for a teaching position in the current school, and where she had been teaching for the last 6 years. Over these 6 years, her capabilities and skills had been recognised, so that in addition to teaching mathematics, Deanne was also teacher in-charge of the school senate, Head of Humanities Faculty, as well as Head of one of 4 Houses in the school at the time of participating in this study (i.e. 2001) (DN3). One of the duties and roles expected of the Head of House was the provision of pastoral care to students of the House.

The year had been additionally busy for Deanne as she was also teaching Year 11 Mathematics Methods for the first time. Further, it was the first time she was teaching

calculus (DP1: 43-44), a topic offered at the equivalent of Year 12 in Canada, and one which many Canadian students considered to be difficult (DP1: 49-61). Nevertheless, Deanne had chosen to teach this topic because she had enjoyed taking over a lesson on 'limits' the year before (DN1). She admitted, though, that she might have taught it better in 2001 if she wasn't as busy with school administrative duties that year (DP2: 3-6; DP3: 233-234).

Deanne was interested in this research study all along. She had responded to the survey of immigrant teachers sent out to mathematics coordinators in late 2000, indicating her interest and inviting me to contact her.

In 2001, Deanne was given a substantial amount of school administrative and leadership responsibilities. She was unable to respond to the teacher questionnaire sent out to her in early 2001. By August, it became clear that there would be no teacher participant who had migrated to Australia from the American continent. The few American teachers identified in the survey of mathematics coordinators were sent another letter of invitation to participate. Deanne replied favourably to this second invitation, apparently sensing my need for a teacher participant from America. As she told her class when introducing me to the students:

> he's got teachers from all over the place, from different countries, and no one from North America.
> So I'm the North American delegate (class laughter)! (DL1: 6-8)

It was apparent that being so busy that she was, Deanne's decision to participate was purely based on her desire to fill a perceived gap in the distribution of teacher participants of this study. She wanted to help me out, and so it was not so much for professional development reasons that she had come on board. Throughout the interaction period with Deanne, we had to be very disciplined with time spent working together so that she would not be late for her many school commitments (e.g. excursions, meetings).

Over the period in which we worked together, the relationship that evolved was more of an official one. Deanne did tell me about her upcoming tenth wedding anniversary celebrations, as well as her upcoming holiday trip to Canada. She also shared with me her interest in alternative algorithms, in response to which I faxed her the Russian Peasant Method for multiplication which I introduced to her during the conversation. However, she seemed to pull back whenever she felt that she was talking 'too much' about things

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that were not related to mathematics teaching / learning. Was a heavy work schedule possibly a factor here?

Nevertheless, the experience of participating in this study did raise Deanne's awareness of the implicit values teaching that took place in her lessons. The impact of my visiting her lessons and talking to her about each of these afterwards may be understood from her reflection at the end of the data collection:

> I think it's been good just to have somebody observing in my classroom, because I haven't have that probably since my practical rounds, so it's always good to have somebody to come in to see what you are doing and to give you some comments. It has made me think a little bit more about some of the — more beyond conscious ideas that I'm putting across. You know, it sort of really came to light today after the circular function lesson, not going so well, and today, even my enthusiasm for the topic really does affect them. So, then after talking about these cultural differences, whether that's something which I could insert more of, given that I do have that effect. Even if it's just something little that I can add in that might change the way that they think slightly. I thought that would be a good thing. So it's been good! (DP3: 297-308)

Although Deanne had probably started off with the intention of helping me out with the study, and her work demands meant that we had to be very strict with time, her contributions during our interactions appeared to be genuine and valid. The triangulation afforded by the multiple data sources did not reveal any inconsistency amongst Deanne's data. Her reflection above of her role in values portrayal was also likely indicative of Deanne's personal involvement in the study.

5.4.1.2   Current School and Community Context

The 17 students in this Year 11 class observed were predominantly Anglo-Saxon in ethnicity. As the class achievement was generally low, Deanne's focus with the class was very much examinations-based (DP2: 21-22).

The school within which this class was situated and within which Deanne had been teaching for the last 6 years was an independent (non-denominational), coeducational school in country Victoria. The school, 120km from Melbourne, was staffed by 31 teachers and catered to the education of 435 Grade 5 to Year 12 students in 2001.

In Deanne's opinion, Australia students' and their parents' expectations and valuing of achievement in school mathematics were not as high as their Canadian counterparts:

> from the parents I have dealt with, the maths was very highly valued, but if the student couldn't do it, it was that perception of 'just couldn't do it', that's okay. And here, I think, parents think it's great when their kids do well at maths, it seems to be okay not to. I don't know whether that has to do with the community that I'm in, or, I

don't know, I feel awful saying that, it just sounds such a — but you know, you get lots of parents saying that, "oh, you know I was not good at it" and "I couldn't do it".

Interviewer: Do we hear that more often in Canada?

Deanne: No.

Interviewer: In fact, it's more okay that "I did terribly bad in maths at school."

Deanne: Yeah, that's what I'm trying to say, but it seems to be more okay not to, you know.

Interviewer: Do you think a kid will be more readily confident to say in words that "I'm good in maths," relatively?

Deanne: No, I don't think so, which is a shame that it doesn't seem to be something to be particularly proud of. Maybe at the senior levels, but when you get to the last year of school, those maths, some sort of it's cool not to be good at it, I guess. It's a battle, isn't it? (DP3: 268-290)

Having been educated in the Canadian culture and educational system, Deanne had also noticed differences in mathematical terminologies in Australia and in Canada, such as those shown in Table 5.4 below.

Table 5.4

Different Terminologies of Mathematical Concepts in Australia and in Canada

Australia	Canada
simultaneous equations	system of equations
gradient	slope
f dash x	f prime x
$y = mx + c$	$y = mx + b$

In response to such differences, Deanne would normally make use of the term used in the Australian classroom (DP3: 186, 189-192),

really making a conscious effort to change my terminology to fit the expectations of the school .... [and also] because that's what they are going to encounter when they leave me, that's what they are going to encounter in their text. (DP3: 191-192, 216-217)

though she would at the same time make it known to her students that alternative terminologies existed to describe the same mathematical concept (DC),

really emphasise that it's just a difference in language, there's no difference in technique. (DP3: 187-188)

In fact, in instances when Deanne felt that the Canadian terminology was more appropriate than the Australian form, she had the tendency to use them interchangeably:

if it's something that could aid their understanding, I would still perhaps use both at times. (I: Use both?) Well, I wouldn't be so worried about using the wrong terminology I suppose. (DP3: 198-201)

Examples of terms which might be used interchangeably in Deanne's lessons were: 'gradient'/'slope' and 'simultaneous equations'/'system of equations' (e.g. DL3: 436, 438).

5.4.1.3 Personal Values and Beliefs

Deanne viewed mathematics as being a way of learning, since mathematical skills are readily transferable to other subjects (DC). To her, the value of the subject lies in cultivating logical thinking and more pragmatically, in creating more career/study options:

> maths is a very key subject that every student should have learnt, and even though they may not use the mathematics, I think the way of learning it is good training for future learning. Some kids get the importance in that sense.

Interviewer: Future learning: would you look in the sense of future career, the more practical and materialistic aspect?

Deanne: Yeah. I suppose I am thinking about just in terms of the way of studying, the way of logically, sort of, make the sequence in which you attack a problem.

Interviewer: Training for the mind?

Deanne: Yeah, yeah. That's how I looked at it. So I think it's important.

> It's also, it is valued in the workplace. Students that continue with mathematics will certainly have more options open to them as far as what they can study later on, and as far as what they can do. And that, it sounds like a real snob, I guess. But it's sort of like it's something that is highly valued. (DP1: 276-292)

For Deanne, assessing student knowledge of the First Principle formally was one way of promoting student logical reasoning skills:

> first principle is something that you can test their skills of logic and reasoning. Because then they have to go through the steps rather than punching into the calculator or applying the rule. It's something that they really have to set it up probably, to show the steps clearly, which is something we do really value, that everything is set up the right way. (DP3: 160-164)

Mathematical skills were not perceived to be a set of algorithmic steps which students were expected to memorise and reproduce:

> I think that's what makes a really good mathematician: it's somebody who has lots of tools that they can draw on, and they can look at the situation and say, "well, I'll just try and do it this way, and experiment, and modify as they go." Those are the ones who do really really well, because they are not limited to 'if it's this, then I do this', which becomes a problem. Because you're going to always come across a situation which doesn't look like this, and all of a sudden you might have to think backwards, or, if you've got lots of different ways of thinking about something, you might quit and to approach a question with that sort of curiosity, as in "how am I going to solve this?" as opposed to "well, it's this, so I do that." (DP3: 109-117)

In the teaching of mathematics, Deanne clearly valued student *confidence*. For the class observed in particular, where student ability was relatively weak, Deanne felt that

the students' mathematics learning experience would be much enhanced by a boosting of student confidence in understanding and achieving in the subject (e.g. DP1: 185-191; DP2: 22-24; DL3: 118-119, 148; DP3: 128-138, 235-239, 245-249). Seemingly complicated topics, such as the First Principle in calculus, were actually utilised by Deanne to boost student confidence in the class observed:

> getting back to this class, we had a really fun time doing first principle, because we did — it was the first time that they do a whole page, some of them took a whole page to do a question. And we got to the end of it and was saying, "oh, isn't that great! We started with this, we ended up with this. Look at how much we've done! Isn't that fantastic that you know that much mathematics that you can do that!" And being a weak class, it was something that by the end of the lesson when we first introduced that, they could all do it. And they could all do it well. That's why I wanted to do that because it also builds confidence for the exams. Like, they look back, "that was really difficult, and I can now do that!" It's sort of, you know, "if I can do that, I can manage to grasp that bit more." That was deliberate, because it's something they can do and be really successful at, as well as getting an understanding. (DP3: 128-138)

Student confidence was also encouraged through 'little' gestures during Deanne's interaction with her students. For example, after completing a lengthy solving process for a problem sum with the class, Deanne put a large tick and drew a happy face by the solution, commenting to the students with a smile that

> that will be you after you do the examinations, right? (DL3: 118-119)

Related to increasing student motivation is Deanne's promotion of student *understanding* and *enjoyment* of mathematics (e.g. DP1: 84-87, 121-125; DL3: 164-165; DP3: 124-138). After all,

> I see what's so crucial in mathematics teaching is maintaining that interest, and the notion that they can do it. We see too many kids that's just, they come to the class and they are beaten already. Because they found it a difficult subject, and they don't enjoy it. They feel frustrated. It makes them, you know, they feel out of their depth, and that's just awful. (DP1: 121-125)

These were such central values to Deanne that they overrode her valuing of *precision*, which will be discussed later on in this chapter:

> I think that it kind of caught on as a class. And I think, ultimately, while I do think that notations is important, and formality is important, I think it's more important that they understand and enjoy mathematics. So if I have to sacrifice 'plus c' for 'chucking in a c', I will. (DP1: 84-87)

These personal values and beliefs were clearly concerned with improving student affective readiness to learn. In her opinion, dealing with students struggling with mathematics should be about changing how content is taught, rather than selecting the content to be taught (DC). That Deanne has been emphasising these qualities since her teaching career in Canada has also meant that her approach to teaching did not go through a complete overhaul after her arrival in Australia. She continued to value student

motivation, as well as to make use of humour during her teaching to facilitate student learning. Furthermore, she was also using some resources such as textbooks and activity worksheets from Canada in her Australian mathematics classroom (DC).

5.4.2   Nature of and Responses to Perceived Value Differences

5.4.2.1   Precision (Mathematical)

A difference in the way Australia and Canada were seen to value mathematics was demonstrated by the students' competency in the subject's language and notations, although Deanne felt that the curricular expectations of these in the two countries were "fairly similar" (DP1: 98-101). In Canada, there was an emphasis on formal language and notations from the early years of a student's mathematics education process (DP1: 256-266), whereas this emphasis was felt to be weaker in Australia.

For Deanne, this value difference affected her because of her belief about the nature of mathematics:

Interviewer: I noticed that you wrote this on the board: 'general notation', and I think, when one of the chaps in front talked about, "just chuck in c, just chuck in the c," and you commented, "this is too casual!" Do you think that there is a need for students to be able to be not so casual when they are talking about notations, that when they are talking maths, that they should be talking to a certain degree of technicality.

Deanne: I think I do, and I think there is the formality to mathematics, which is, it's part of the tradition, and I think anyone has to uphold that. (DP1: 63-70)

When probed further, Deanne elaborated that she valued the *precision* that is inherent in the subject:

Interviewer: You uphold the value of students talking in terms of more formal and technical language. Could I just lead you down that a little bit, and perhaps for you to nominate in one word or a phrase what value does that signify or exemplify, or, why should students be able to do that?

Deanne: Oh, okay. Hmm, I think mathematics is a precise subject, and I value precision. And I think the language is an important part of that precision. To be able to communicate in the language of mathematics is part of it, just as much as setting out a question properly. To be able to talk about it in those terms.

Interviewer: Even if a student does not learn or take up maths anymore in the Year 12, do you think that it's good practice for them to cultivate the habit of talking precisely?

Deanne: Definitely, because I teach English as well, so — I mean, language is precise, language is important to get the right word to describe what you are talking about. So I think language is important across every subject, and every subject has its own language .... Exactly that, because I suppose rather than saying something in a roundabout way, mathematics allows us, just like algebra might allow us to simplify an equation. The language of mathematics allows us to simplify a technique, or a tool because of the preciseness of the language, that you can use one word to say

simplify, or evaluate, or integrate, or any of those words which allow us to know precisely what we are doing.

Interviewer: And that is important?

Deanne: I think it is, to be able to articulate what you want to say. (DP2: 197-212, 221-229)

Inherent in the quote above was Deanne's other emphasis on *conciseness*, so that things needed not be said in a 'roundabout way'. This was demonstrated in some of the comments she made in student written work:

you could be ... more concise in your explanations in this first section. (DA5)

your explanations are concise. (DA7)

There were many episodes amongst the lessons observed in which Deanne presented and explained concepts, skills and instructions with the use of formal terminologies. Some of these were accompanied by clarifications (e.g. DL1: 67-79, 96-100, 249-252), which one may argue was a common practice in any mathematics classroom, such as:

if you just have a look at the question, if you look at dealing with z now, that z at the end, which means that we're finding the anti-derivative with respect to z. So that dz at the end means with respect to z. That's all part of the notation. You should be careful using that notation. (DL1: 249-252)

However, there were also incidences when Deanne expected students to have understood and internalised notations or terminologies taught earlier, such that these became part of her discourse in class (e.g. DL2: 36, 46, 47; DL3: 17-40, 394-396, 407-412, 456).

Much more illustrative of Deanne's emphasis on the use of formal language in mathematics was her interaction with students in class. In particular, Deanne modelled the use of the appropriate formal language in response to student use of more colloquial terminologies. The following are several examples illustrating this:

Deanne: Try this one: 8x to the power of 7 dx. Think about what did I start with when I took the derivative?

Student: It's pretty much the same, when we chuck the c on.

Deanne: What do you mean it's the same?

Student: The same as what we used to do, just chuck in a c. add on c.

Deanne: That's too casual. (S: Add on a c) Okay. (DL1: 119-128)

Deanne: Okay, you've got π, π is going to be there. So where's π by 2?

Student: Up high.

Deanne:	Up high.
Student:	90°
Deanne:	90°. Thank you. Don't say 'up high' in your report.
Student:	We understood.
Deanne:	I understood, but your calculator might not. (DL2: 177-189)

Student:	Don't you put that h in front?
Deanne:	Oh yes, that's right, okay. Put that h out in front, or, in other words —?
Student:	Factor.
Deanne:	Factor! Factor out your h from the top. Why do I have to factor out the h from the top? (DL3: 93-100)

Student:	Get the threes out.
Deanne:	Well common factor the 3 out. (DL3: 429-431)

Student:	So I can just take out all the threes, and things —
Deanne:	Oh, what I did was I factored out 3 from both sides, and then divide both sides by 3. (DL3: 440-442)

Through these examples, we can see that formal language was valued either by encouraging students to use the precise terms, or through Deanne's modelling by rewording of students' statements in more formal language. Deanne reiterated (e.g. DP1: 71-73, 94-96) that she would have emphasised the use of formal language in her mathematics class more if she wasn't teaching the grade level for the first time:

> it's something I probably would be more strict about, perhaps the next time I go through it and I can start to - right now, I guess this year I've been focussed on getting the concepts across, and having the students being able to find derivatives of graphs and functions. I can then focus on finetuning that if you like, getting those formalities and things done. (DP1: 92-96)

This, then, appeared to demonstrate that Deanne's valuing of *precision* might be overridden by other factors deemed more important, such as *concepts* and *skills*. After all, the use of formal language was not directly tied to improving student understanding of concepts and attainment of skills.

Deanne did wonder if teacher emphasis of precision through formal language in mathematics was all that important (DP1: 111-112). Another factor which appeared to

override her concern with formal language in her teaching experience in Australia was student *confidence*. Especially with the class observed, whose students

> have done well in maths in the past, but they haven't excel [sic]. They are not finding it very easy. They have to work hard at it. And one of the ways that I encourage that particular group to work at it is to, sometimes not to get too caught up in those formal, scary things. If they are happy to, if they can say, "chuck in a c on the end," and to them that means that we need to have a variable, and they know why, I guess that's what the most important thing is. And if they can have a bit of fun by saying, "chuck in a c", and I think that was something from, and I can't remember from what topic, you know, "chuck it here." And I think that it kind of caught on as a class. And I think, ultimately, while I do think that notations is important, and formality is important, I think it's more important that they understand and enjoy mathematics. So if I have to sacrifice 'plus c' for 'chucking in a c', I will. (DP1: 77-87)

Indeed, her concern for student confidence was a point which Deanne mentioned several times in our conversation (e.g. DP1: 121-127, 185-191; DP2: 22-24; DP3: 128-138, 235-239, 245-249). On the other hand, Deanne recognised that she was to try to find a balance here, since student use of formal language also played a part in promoting their interest and confidence in the subject:

> another thing that helps those weak kids, if they are using the language of mathematicians, and sounding like mathematicians, then they get a sense of doing it, being part of that mathematicians' community. For some of them, maybe the language part is the part that they grasp, because they might be strong linguistically. So if they're getting the right terms and using the right words, they are part of that community .... That will raise their confidence levels, because then they may not understand the big, long equation on the board, they know when I say 'derivative', they know what that is. So they are already involved at that level, and ready to move on. (DP2: 238-249)

This consideration of Deanne's, together with her knowledge of individual students' mathematical ability, may possibly explain the apparent inconsistencies observed in her grading of student written report. Thus, in a script awarded 20 marks out of a total possible of 25 (DA5), Deanne highlighted (by underlining) to the student the latter's use of non-precise term, 'in conjunction' (Figure 5.6). On the other hand, in another script with a lower score of 18 marks (DA9), she did not single out the student's use of 'plugging in', a colloquial term for 'substituting the values in' (Figure 5.7).

Figure 5.6. Deanne's reaction to a student's use of imprecise language, 'in conjunction'.

Figure 5.7. Deanne's tolerance of a student's use of colloquial language, 'plugging in'.

THE BEST DESIGN FOR THE ALUMINIUM CANS.

By using the Excel program we were able to find the best design for the aluminium can. This was done by plugging in the formulas, to which we found the best design for the cans to be: ✓
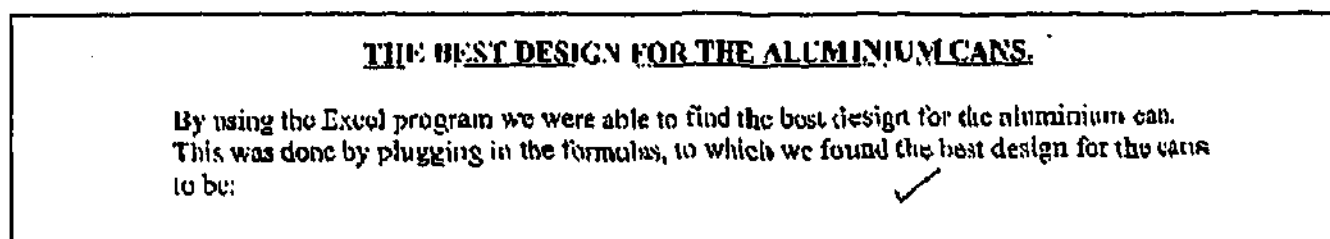
Another category of apparent inconsistency was observed in a script receiving a score of only 13 out of 25 (DA4). The student had tried to describe the values 4.6, 4.7, 4.8, 4.9, 5, 5.1, 5.2 as 'the values which are with in [sic] 3 decimal places of 4.9' (Figure 5.8). A tick was placed next to this statement, and there was no written remarks from Deanne alerting the student to her use of imprecise language. This same incident happened three times in the same report. Yet, a few questions down the same piece of work, Deanne expressed her concern (by underlining and including a question mark) with the student's imprecise use of language for 'equating the equation to zero', as illustrated in Figure 5.9. Could Deanne possibly be more lenient initially with this student of relatively lower ability, then reminding herself later on in the same assignment that with the kind of marks the student was scoring thus far, it might not make much difference to it anyway if she was to become more particular with the student's use of mathematical language? Or could it just be simply a case of Deanne overlooking the student's incorrect use of language in some instances while grading the students' work?

Figure 5.8. Deanne's marking of a statement containing imprecise/incorrect language, 'with in 3 decimal places'.

The minimum surface area is the lowest for 1000ml when the radius is at 4.9 the following table shows the surface area at 4.9 and also the values which are with in 3 decimal places of 4.9 ✓

4.6	5.641125	295.9956794	7.5215	350.3435054	11.28225	459.0391576
4.7	5.403631	298.3700315	7.204841	351.5615209	10.80726	457.9444996
4.8	5.180825	301.0145895	6.907767	353.0979228	10.36165	457.2645895
4.9	4.971521	303.9205037	6.628684	354.9409119	5.94567.1 456.907.282	
5	4.774648	307.0796327	6.366198	357.0796327	9.549297	457.0796327
5.1	4.589243	310.4844734	6.118991	359.5040812	9.176486	457.5432960
5.2	4.414431	314.1280999	5.885908	362.205023	8.828861	458.3588692

Figure 5.9. Deanne's reaction to student use of informal language, 'by setting for 0'.

The derivative of $\frac{375}{r} = -\frac{375}{r^2}$?
to find the min surface area by setting for 0 and
solving for r

5.4.2.2 Alternative Assessment (Mathematics Educational)

During Deanne's professional experience in Canada, mathematics assessment there
had been pretty much examinations-based. She noticed the shift in Australia towards
alternative assessment practice over the previous few years, especially at the lower
secondary levels, where there were

> many longer-term, problem-solving projects with a formal write-up of aims, and results, methods,
> conclusions. (DP2: 117 - 118)

In making this observation, Deanne was aware that she might be experiencing what I
called the 'cultural freeze' phenomenon (DP2: 105 - 106), in which an immigrant's
conception of her own home culture froze at the time of her departure from that home
culture. Thus, the possibility that practices and norms in the home culture might have
changed during the time the immigrant had been in the new, host culture might elude the
immigrant's conception. A daily-life example of the 'cultural freeze' phenomenon might
be someone returning to a culture after a period of absence, and expressing surprise that
the price of a particular commodity has risen, or that the youths there were not what they
used to be before, when she was in that home culture.

Nevertheless, Deanne embraced the practice of alternative assessment because she
believed that

> not everyone does as well in a test situation, and, you know, trying to remember everything. (DP2:
> 109 -111)

She had certainly found these alternative ways of assessing student learning helpful for
her students. In doing so, it was apparent that there were facilitating factors in the wider
community, such that

> there is much more room to do some alternative assessment, which is great. (DP2: 109 - 110)

5.4.2.3 Power Distance (General Educational)

The nature of the Canadian school Deanne taught in was mentioned earlier in Section 5.4. `. Teaching in Australia had made Deanne aware of a different set of student expectations. To her, at least, there was a valuing of (student) *respect* for teachers and subsequently a valuing of *power distance* in Canada. The casual, friendly teacher-student relationship she encountered in Australia, however, had meant that this respect was not automatic and had to be earned (DC). It certainly would not come about by virtue of Deanne's position as teacher, something which she experienced while teaching in Canada. In Australia, Deanne found that students' success in tests/examinations might be one of their means of determining the degree to which respect should be accorded to the teacher (DC). There was also an expectation amongst students of teachers to work *for* them. For example, Deanne recounted an incident when a student passed her an essay at 3pm and expected her to grade it by the next day (DC).

Nevertheless, Deanne had been enjoying the relatively casual teacher-student relationship in Australia, one which did not value *power distance* too much. She had no trouble embracing it in her professional life in the school (DC). In fact, as Deanne found out, she might have turned out to be too personal in her interactions with her students for their 'comfort'. Perhaps, due to the small school community and because of her involvement in the school extra-curricular activities, Deanne had found herself discussing personal topics with students more in Australia (DN2). In some of these instances, students reminded her that she did not have to tell them that much (DN2).

5.4.2.4 Diversity (General Educational)

Deanne expressed her concern at the different emphases with which ethnic diversity was seen to be projected by textbooks and assessment questions in Australia and in Canada. She shared with me a few Canadian mathematics textbooks, in which

> you often see people of different nationalities ... whereas in the Australian books, there is very strong 'John', 'Tim' and 'Sarah'. You will come across all sorts of names and things [in Canadian textbooks], which I think is a very good thing which we are lacking here .... (Referring to a particular question in a Canadian textbook) And here we have 'Takzan has three times as much as Paul'. We are not going to see that in an Australian book .... You think there is a very strong Aboriginal community in Australia, and yet you don't see a lot of Aboriginal names up in our textbooks, which is a shame. (DP3: 1-4, 9-10, 89-91)

The relative lack of ethnic representation in textbooks has been one of the findings in McKimmie's (2002) comparative study of three Victorian mathematics textbooks. For Deanne, the implicit messages portrayed by textbooks were a source of concern because both the Australian and the Canadian mathematics classrooms were "pretty dependent" (DP1: 15) on the textbook, and thus these publications could be influential on young minds. Further, there were already very few cultural differences in the community in general, and in the school population (DP3: 6) in particular. Thus, Deanne has observed that

> you might be having a conversation with kids particularly given what happens [sic] in the States [ie the September 11 tragedy at New York], and with the refugee crisis [ie the plight of asylum seekers at detention centres in various parts of Australia]. Some of the attitudes are quite shocking at times, part of that is because they are kids, and part of that is maybe they are attitudes they get from older parents. But they are not quite as embracing difference as I like them to be. (DP3: 43-47)

As an immigrant teacher speaking with an American accent, Deanne had also been a target of the community's relative de-emphasis on *diversity*, although she did not appear to have been personally offended:

> I don't mind them having a joke with me about that [accent], but if I came across from behind someone there was imitating my accent, that would make me quite angry, because they weren't doing that as fun; there's a different attitude towards that. (DP3: 25-27)

What was of concern to Deanne was the possibility that her community's general lack of valuing of *diversity* was a reflection of a similar situation in metropolitan Melbourne, which like other parts of Australia was becoming increasingly multi-ethnic. After all,

> the textbooks that we use [here in country Victoria] will be the same as the one they'll use there [in metropolitan Melbourne]. And still we're seeing the same sort of names [in the textbooks]. (DP3: 21-22)

Deanne valued *diversity* enough to want to continue to emphasise it in her Australian classroom. She did this in several different ways. For instance, she would emphasise to students the nature of school mathematics as a subject that is studied and used by people all around the world (DP3: 28-30, 52-53), and as "something that ties everyone together" (DP3: 31). She would also be explicit in her expressions of how particular problems may be solved differently by different ethnic groups, thereby demonstrating the language of mathematics as an universal language (DP3: 59-63). This notion of mathematics serving as an universal language was highlighted in one recent lesson:

> I was saying that it was a f prime x, and the German boy [in the class] was saying that it's f line x. Everyone had a different take on it, but it was the same thing. And he still knows how to do it from

the symbols. The symbols were the same, there were slight changes in the way we say things. (DP3: 64-68)

By explicitly valuing (ethnic) *diversity*, Deanne hoped that students might become more aware of the similarities shared by people in different parts of the world. In this way, mathematics

> could be a valuable tool in perhaps creating some understanding of difference, and not to be afraid of people who are different. (DP3: 72-74)

Deanne also attempted to promote the valuing of *diversity* through including different ethnic groups in the contexts of mathematics questions (like in the Canadian textbooks) (DP3: 53-59). While her efforts in this regard might be facilitated through her reference to — and use of — overseas textbooks, she also identified the positive role played by her school in supporting her research in this area. In this regard, she advocated institutional support in

> looking at developing the text[book], so that you do see — when you have pictures of kids doing activities — that you have a lot of difference. (DP3: 88-89)

At the same time, Deanne also suggested possible teacher professional development support at the local level, such as the bringing together of teachers of mathematics who represented different cultures but shared the common experience of practising in Australian classrooms (DP3: 85-87).

5.4.2.5 Professional Support (Organisational)

Deanne had also found that *professional support* was valued differently in Australia and in Canada. In her opinion, the level of this support was lower in Australia. Even for textbooks,

> they [the Canadian textbooks] have some really fantastic activities, and lots of ideas for lessons, whereas I find the text and things have activities for kids, there isn't a lot for, directed at teachers.

Interviewer: The texts here, or?

Deanne: Just in the methods of teaching.

(DP2: 139-145)

Deanne noticed the same for professional journals in Australia and in Canada as well. Deanne mentioned two particular American resources, RHYME and the journals published by the National Council of Teachers of Mathematics (NCTM). It was interesting that Deanne had considered the NCTM resources as Canadian, since NCTM is a mathematics teacher professional development association based in Virginia, USA. This

might be because the neighbouring status of Canada and the USA has resulted in a relatively high level of exchanges and communication between the two countries. In fact, some of the regularly-held NCTM regional conferences are held in Canada as well, such as one which took place in Alberta, Canada in November, 2003.

The difference in the nature of departmental meetings in Deanne's schools in Australia and in Canada also contributed to the perception of this value difference. In Australia,

> it's more administrative meetings: whether the examinations is going to be written, and that sort of thing (laughter), rather than sharing ideas. (DP2: 181-183)

The mathematics meetings in her school in Canada were run differently:

> some of our mathematics meetings were focussed on lessons and what we were doing in class.

Interviewer: The regular faculty meetings?

Deanne: Yeah, the regular faculty meetings that you might have some professional development aspects .... We all were very interested in spending our meetings talking about how you might improve the skills in fractions. (DP2: 170-175, 180-181)

This 'phenomenon' may be explained in part by the fact that in her school in Canada, Deanne's department was made up of only mathematics teachers, whereas the school department she belonged to in her school in Australia was called the 'science, mathematics and technology faculty'. That is, the department's teachers were teaching different subjects. Also, in Canada, all mathematics teachers occupied the same office (DP2: 166), whereas in Australia, "we are all sort of scattered about" (DP2: 167). Nevertheless, these were also indicative of the degree to which *professional support* was emphasised in Australia. Further,

> I think Australian schools generally - and I think this is true from the people I've talked to - tend to be busier. There seems to be a lot going on, and so there doesn't seem to be the time to sit down and really collaborate, which is what I would like. I think that is a sad thing, because when we do get together and we do have a chance to think about how we are going to approach a topic, or we are going to try something new, you get quite excited about it. That's what you do when you are able to talk about it. And if you don't have the time set aside to do that, when people are too busy, I think it'll affect your teaching. (DP2: 184-191)

The nature of this perceived value difference, however, could not be satisfactorily classified as mathematical, mathematics educational, or general educational, in the way that Bishop (1998) had used these terms (as discussed in Section 2.2.5). Yet, the different ways in which *professional support* was valued in the two countries affected Deanne's professional planning and/or practice. The source of this value difference might be seen to

be at the systemic level, related to schools' organisation of mathematics teachers, schools' workloads, nature of professional development opportunities, and the context within which textbooks were written and produced. For this reason, a new category of value difference, called 'organisational' was introduced in this study and added to the first three, so as to represent the scope of immigrant teachers' perception of value differences in their own mathematics classrooms.

Deanne's response to this value difference was facilitated by her personal valuing of *professional support* and her continual access to Canadian teaching resources. In fact, her upcoming holiday trip to Canada would also see her acquiring more teaching resources there. She has also been making use of some of the existing Canadian resources she has with her in the mathematics classroom. Thus, Deanne was able to sustain her valuing of *professional support* in her own way, exhibiting the traditional responsive approach (see Table 2.3) to negotiating this perceived value difference.

5.4.3 Responsive Approaches and the Underlying Factors

As discussed in the last section (Section 5.4.2.5), Deanne's experience has suggested that the types of value differences perceived by immigrant teachers of mathematics in their (Australian) classrooms may extend beyond that of mathematical, mathematics educational, and general educational, to also be of organisational in nature. That is, there can be aspects related specifically to mathematics teaching and learning that are institutional in nature (e.g. the nature and level of support given to mathematics teachers), and which are valued to different degrees by different institutions in different cultures. As a result, teachers practising across these cultures may experience value differences that impinge on their respective pedagogies.

A matrix summarising Deanne's experience with perceived value differences, similar to the value difference matrix set up for Carla earlier, is presented in Table 5.5. Again, as was the case for Carla, the value differences had been listed according to responsive approaches to reflect the focus in this section on the different ways Deanne (and the other teacher participants) negotiated the perceived value differences.

Table 5.5

Value Difference Matrix for Deanne

Value difference	Nature [a]	Responsive approach	Contextual factors [b]
Diversity	GE	Culture-blind	(+) Multiculturalism
			(+) Mathematics as a way of learning.
			(+) Lessons' dependence on the textbook.
			(+) School support for her research into this value differences.
			(+) Little cultural variations within the school and in the community.
Professional support	O	Culture-blind	(+) Professional support network
			(+) Access to Canadian teaching resources.
Alternative assessment	ME	Accommodation	(−) Not all students do well in tests.
			(−) 'Cultural-freeze' awareness
			(−) Room within the curriculum for this form of assessing
Power distance	GE	Accommodation	(−) Personal preference for what she encountered in Australia.
			(−) Deanne's involvement with house and senate activities.
			(−) Small school community in Australia.
Precision	M	Appropriation	(−) Student concept/skills
			(−) Student confidence
			(+) Professional induction in the 'old school' environment.
			(−) Personal doubts about the relevance of 'precision'
			(+) Promotes the values of *confidence* and *interest*
			(+) Conciseness

Note. [a] The nature of value difference may be:

      mathematical (M),

      mathematics educational (ME),

      general educational (GE),

      organisational (O).

[b] Contextual factors may be:

      facilitating (+), aligned with the home culture value,

      constraining (−), aligned with the Australian value.

When Deanne noticed that the Australian mathematics textbooks did not sufficiently reflect the ethnic diversity of the Australian society, her concern was further deepened by her awareness of little cultural difference in the immediate school population and local

community, as well as her understanding that mathematics lessons were dependent on textbooks. Deanne's attempts to identify ways to inculcate the value of *diversity* through her mathematics teaching were clearly supported by her school as well. Thus, all these factors facilitated Deanne's culture-blind approach to the perceived value difference, whereby Deanne validated the importance she placed on promoting greater student awareness and sensitivity to the multi-ethnic nature of the society, and of school mathematics.

In fact, she was probably empowered by these facilitating factors; not only did Deanne appear happy with her portrayal of *diversity* in class, she was also suggesting ways in which the emphasis on *diversity* could be further fostered in contexts beyond the mathematics classroom (e.g. relating to textbook production and teacher professional development support). At the very least, this demonstrated the potential for teacher empowerment and professional development as a result of positive institutional support. Deanne's perception of the two countries' difference in the valuing of *professional support* had also prompted her to react in a culture-blind manner, that is, she continued to believe in the benefits of the kind and level of professional support that was available in Canada when she was there. Again, this took place in the context of factors which were all facilitating, that is, her personal valuing of *professional support*, and the continual supply of Canadian teaching resources.

Deanne's personal values and beliefs had also guided her response to her perception of difference in the valuing of *power distance* between Australia and Canada. She personally preferred the casual relationships between teachers and their students in Australia. As for the perception of a greater valuing of *alternative assessment* in Australia, Deanne's personal belief that traditional tests and examinations could not accurately measure student learning had led her to embrace *alternative assessment* herself. Deanne's awareness of the 'cultural freeze' phenomenon contributed another factor against not valuing *alternative assessment*, as was the case in her Canadian school. There was even an institutional factor, in the form of opportunities given by the availability of space and time within the curriculum design for alternative assessment to take place. For both these two erceived value differences, the contextual factors were all constraining towards the upholding of what were valued in Canada. Supported by personal values, Deanne accommodated to the Australian values.

Thus, Deanne appeared to have responded to value differences in the culture-blind way when the contextual factors were supporting what was relatively more valued in her home culture. The accommodation approach was adopted, however, when the contextual factors involved were constraining. That is, when they were more aligned with the values associated with the Australian culture. As for her perceived difference in the way the countries valued *precision*, however, there were both facilitating and constraining contextual factors. These had resulted in an unique teaching style evolving for Deanne, one that saw the associated values from the two countries interact together, preserving what Deanne valued in her Canadian experience but also accounting for what were valued in Australia.

5.5 Manoj

5.5.1 Introducing Manoj

5.5.1.1 Personal Background

Manoj is a male, Fiji Indian immigrant teacher (MC; MP3: 378-390). He qualified as a teacher in Fiji, and taught there for four years prior to his migration to Australia with his then young family in 1973 (MC). He was nearly 55 years old at the time of working with me on this study (in 2000). He had decided to leave Fiji to provide his children with a life which emphasised more *fairness* (MP3: 432-440), a value which might have been cultivated by his undergraduate study experience in New Zealand, and/or by the experiences of relatives residing overseas. The main reason Australia was chosen as his migration destination was the proximity to his wife's family members (MP3: 442-449).

Manoj was definitely not a newcomer to value differences in the context of his professional practice. The first few years of teaching in Australia had not been easy, and he had come to accept what he encountered locally as they were, instead of getting too worked up over them (MP2: 340-358). He had come to recognise that value difference was inevitable, and he was ready to examine what might not be aligned with values he subscribed to (MP2: 310-311). He did not rule out the possibility of adapting or adjusting his personal values as a result of his exposure to and experience in different cultures. In fact, he believed that he portrayed different values while teaching in different countries (MQ 33). Manoj appeared to feel a sense of professional enrichment that had arisen from the privilege of being able to reflect on personal experiences in two different cultures

(MC). As an example, Manoj reflected that over the years he had become more tolerant in his academic expectations of students. He had accepted that not every student can perform with similar high standards. He had come to understand some of their 'shortcomings'. "I have learnt a lot. I have learnt to be tolerant, as I said, and to accept people as they are" (MP3: 458-459).

Manoj was identified by his mathematics co-ordinator as an immigrant teacher of mathematics. He replied favourably to a personalised letter of invitation to participate in the current study. As it was two weeks before the school examinations at that time, and as Manoj preferred for the data to be collected before the examinations, we decided that the three lesson observations would be carried out in two visits, made up of a double-period and a single.

According to Manoj, part of his motivation for participating in this study was to find out more about the role of values in mathematics teaching. As he began to understand more about the study, it was apparent that Manoj assumed the role of mentor, one who was confidently sharing his rich teaching experiences, including those concerned with the negotiation of perceived value differences.

5.5.1.2 Current School and Community Context

At the time of this study, Manoj was teaching in a state co-educational secondary college in a North-western inner-city suburb. It was a medium-size school with about 550 students (MC). According to Manoj, most of the students belonged to middle-class families, many of which were single-parent households (MC). That year, his teaching load included Mathematics at Grades 8, 9 and 11, Chemistry for Grade 12, and Science for Grade 8 (MC). Although the school's student population was multicultural (as was the case in most schools in Melbourne), Manoj considered that 95% of his own students were culturally different from him (MQ9). That is, there were few students in the school who were Indian.

The lessons were observed in Manoj's Year 8 mathematics class. Of the 24 students in the class observed, there was a fair distribution across ethnicity, although, again, none of the students in that class appeared to be Indian.

Manoj had obviously established his credibility in the school as an effective teacher (MP2: 265-277). These days, neither his students nor their parents expressed any doubt over his teaching technique (MQ 28, 29). The situation was different in the beginning of

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his teaching career in Australia though. For example, there was parental concern over his accent (MP2: 258-261). Manoj also mentioned a racist incident:

> We got one of them [who] said, "You know, when you cut your finger, you still got blood. Red, white, or black?" I said, "I got the same blood as you." (MP2: 262-263)

5.5.1.3 Personal Values and Beliefs

Manoj was proud of his (Fiji) Indian ethnicity, emphasising that his home culture was Fiji Indian, rather than Fijian. Thus, "although my blood are [sic] Fijian, my characteristics are Indian" (MP3: 389-390). Two such characteristics of the Indian culture which Manoj felt to be significant in his profession were an emphasis on *education*, and a personal desire to do one's best (MP3: 385-388), which might be related to the valuing of *effort*.

To Manoj, education was important for the young generation, not just because excelling at school could lead a student to a good job, but also because it prepared a person for life (MC; MP2: 295-298). While he did not expect all his students to do 'big things' (MP2: 308), he wanted them to have done well enough to be independent in their respective futures.

Manoj saw education as a fundamental way for teachers to impart values to help shape students' developing character (MP2: 293-294). "Teachers have a lot of — very big influence in kids" (MP2: 320-321). He identified the following as key values portrayed in his mathematics lessons:

— *respect* (of students for teachers),

— *discipline* (of students to want to learn),

— *relevance* (of mathematics in daily life) (MC).

In terms of his teaching style, Manoj's preferred style was identical to his teaching style in Fiji (MQ 35-36), basically one which was teacher-centred and one in which students valued *effort* (MQ35). Across all three categories of teaching styles, that is, his preferred teaching style and his teaching styles in Australia and in Fiji, direct instruction remained to be used most often (MQ 35-37). Accordingly, peer discussions, student presentations, and group work were often not employed. Even when he allowed students to engage in discussions or group work, limits were clearly enforced; "I still have control over my class because I believe in discipline" (MQ 44c). Thus, he "often emphasise

students to work independently so that they can realise their own strengths and weaknesses" (MQ 44d).

Manoj also stressed to students the importance of using time wisely, a habit which he felt that he personally practised. For instance, towards the end of lessons, Manoj would inform students the number of questions they were expected to have attempted during classwork (e.g. ML2: 266-267, 288-290) if they had been 'busy doing the work I have selected'. These served to raise students' awareness of what was acceptable pacing of work, and what might have constituted efficient use of (study) time.

Another of Manoj's personal values may be discerned from the way he conducted assessment. Each time a test was set for his students, Manoj would prepare multiple sets of test papers of similar difficulty levels. Students who did not perform well in the first set would be allowed to have a second go, with marks awarded for the second try only. Not only was Manoj acknowledging that people make mistakes, he was also emphasising the virtue of learning from one's own mistakes (MC).

5.5.2 Nature of and Responses to Perceived Value Differences

5.5.2.1 Relevance (Mathematics Educational)

One of the value differences identified by Manoj in his questionnaire response was Fiji's valuing of *drills* and *rote learning* of facts and procedures (MQ 14, 42a), and Australia's relative de-emphasis of these for the valuing of *applications*, *relevance* and *problem solving strategies* (MQ 17, 42a). Although Manoj was educated and teacher-trained in Fiji (MP1: 77-81), teaching in Australia has enabled him to appreciate the *relevance* aspect of school mathematics:

> you have to show that the relevance of what you are doing, because a lot of time, what we are doing — to the child, to the students is not relevant .... I think they have to be shown that — the application .... like ratio. You are going to use ratio all your life! All sorts of things: making cake, cooking cookies (I: yup), mixing — herbicide to — you know, to make the right mixture. (MP1: 89-97)

In fact, *relevance* was one of the main things he valued in school mathematics (MC; MP1: 412-420). As he said, "even if one 'becomes a bum', there are uses of mathematics in daily life" (MC). This may be understood bearing in mind Manoj's valuing of *education* and its role in preparing students for lives in the future. Manoj also perceived teachers' roles as including the teaching of knowledge and skills which students could utilise after leaving school (MC; MP2: 295-298).

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Manoj's valuing of *relevance* was also evident in his classroom discourse and actions. For example, he made explicit links between the mathematical knowledge being taught and its application in the outside world (ML1: 630-632). These included aspects which might not appear apparent to others. For example, he was observed to be not just teaching students the order of the Cartesian coordinates (i.e. the positions for x- and y-coordinates), but also stressing the right order, for:

> that order [of the x- and y-coordinates] is also important. But that order is also important not only in school. Everyday you use order. I mean, whether that meal and certain thing. Do they have the meal, or they can have the dessert, or they don't have the dessert, hold down a bit, can I have done yet the dessert, then the meal? So there is a certain order involved, so that — as I said, I think maths teaches them to follow a way, rather than just do it. (MP2: 89-95)

5.5.2.2 Teacher-centredness (Mathematics Educational)

Another aspect of the mathematics education which Manoj perceived Australia and Fiji to have been valuing differently was with regards to the role of the teacher in the mathematics classroom. The typical role of a teacher in Fiji was to impart knowledge (MQ 44b), and this was mainly achieved through direct board-and-chalk teaching (MQ 44a). On the other hand, in Australia, the typical mathematics classroom (in Manoj's impression) was not so teacher-orientated (MQ 44a). Rather, Manoj felt that Australian classes tended to value *student-centred learning*, adopting pedagogical strategies such as student discussions.

Although Manoj mentioned that his teaching repertoire also included student discussions and groupwork (MQ 44c, d), these actions did not appear to be accompanied by a corresponding value shift in Manoj:

> Interviewer: There's people who believe that students ... can learn by discussing with one another, [or] discussing with each other.
>
> Manoj: I have to find it yet (chuckles)! Look, I know what is discussion. In other words, they have this thing. They always, you see, discussions — when you have them — get out of hand. From my own experience, that's what I find. And you find that somebody says from there, and then somebody says there ... Nobody is listening. Everybody is just throwing things around. So, I don't know, to me, I want to be focussed, impart the things that I have to say ... get them over their work ... discussions is all very relevant in ... English or whatever, that's fine. (MP1: 353-365)

In fact, discussions and groupwork had been Manoj's least used teaching style in Fiji, and also his least preferred (MQ 35, 36). The situation had not changed after his years of teaching in Australia (MQ 37). Direct instruction remained his top favourite teaching style in his personal preference and in his professional life in Fiji and Australia (MQ 35-

37). In this respect, the quote below represents the typical discourse that might be found in Manoj's lessons:

> This is a number line going from left to right, okay? And, this is your starting point. Zero is always the starting point, which is called the origin. So if you go to the right, it means it is positive. You're going in the positive direction. If you're going [to] the left, it is the negative direction. If you now have another number line, which is going up and down. One, two, three, four, five. Negative one, negative two, negative three, negative four. Part of the problem ... is that you don't pay attention when I'm explaining something which is basic and relevant. When it is basic, you should understand what we're doing before we go on to it — start doing the actual work. So if you put this onto this, it will look like that. Now, this — erase this first — the horizontal and the vertical in fact is what we call the number line plane. This is your coordinate plane. (ML1: 454-468)

The lessons observed generally followed a teacher exposition — student practice pattern. During these lessons, there were many instances of Manoj establishing his authority as knowledge dispenser (e.g. ML1: 64-65, 252-254, 454-478, 511-525; ML2: 120-121; ML3: 231-234), two examples of which are:

> these values ... are called ordered pairs .... I'll be telling you later on how to plot them and get a kind of graph. (ML1: 63-65)

> you should be careful how you substitute it. So, I will do that one for you on the board so that you know what to do. (ML1: 253-254)

5.5.2.3   Basic Skills (Mathematics Educational)

Another value difference of the mathematics educational nature related to the perceived difference in the valuing of *basic skills* in mathematics teaching/learning between Australia and Fiji. These refer to the mathematical skills which might be used as tools for computation in the solutions of more complex problems. According to Manoj, the Australian school mathematics curriculum seemed to value *applications* more than *basic skills* (MQ 17, 42a). While not discounting the benefits of students being able to apply mathematical knowledge to solve real-life problems (after all, Manoj valued *relevance*), Manoj felt that this capability might be more effectively cultivated through student mastery of basic skills (MP1: 295-298, 338-350, 400-408; MP3: 27-44) first, rather than expecting students to be able to solve applications-type questions straightaway. As he said,

> I mean, they [students] learn by rote learning .... like rote learning the [multiplication] tables, you have to rote learn. Otherwise you will be counting, and then, you can't even multiply .... You [will] have problems with anything you are going to do in maths later in use everywhere .... so I mean, you still need the concept. The basic concept is very important. (MP1: 338-346)

In a lesson on drawing up tables of values, Manoj again emphasised the role of basic

skills in consolidating understanding and promoting applications:

> the rule [of the equation] tells you what to do. It's like a recipe someone has. Here is an example: you have $y = 5x+1$, so y is five times the value of x, so the whole thing plus one. And then you work it out. And then — and then you do it on the graph, a linear graph. And, as the name suggests, you should know what we're talking about. This data gives a linear graph, linear equation. After that, while making sure they have focus through on what I'm talking about, and they are confident before they go on and do some problem-solving type of thing .... Applications, you know what I mean? After their knowledge has been building and building, they must recognise that yes, this is not the sort of formula you've been doing, but you also know how to apply in situations, other than — simple linear equations. (MP3: 31-44)

Subsequently, Manoj was explicit in promoting the attainment of basic skills before applications in his lessons (e.g. ML1: 202-205; ML2: 103-104, 197), as illustrated in the following quote from a lesson on substitution:

> If you cannot do this, you'll be not doing very much in the next period of work that I'm leading into, which is doing — and plotting linear graphs. (ML1: 202-205)

Drills exercises (in class or as homework) were a significant part in Manoj's cultivation of students' basic skills in mathematics (e.g. ML2: 5-10; ML3: 60-184, 355-419). For Manoj, these exercises did not necessarily mean repetitive questions of similar content and/or solution approach, though. In fact, drills questions essentially helped students to develop the necessary understanding. Thus, in his homework (MA 1-i3), the range of questions probed for depth of understanding as well as for breadth of knowledge and skills. This may be demonstrated by Manoj's choice of examples in a lesson on graph plotting. The four equations selected were: $y=2x$, $y=5x+1$, $y=5x-2$, $y=1-x$. On the surface this might appear to be a repetitive exercise in plotting straight lines; Manoj's choice, however, was intended to help students consolidate plotting skills through examining different types of intercepts and different representations of the linear equation. In his opinion, these

> few examples, each one demonstrating slightly different, so that they can see that [when] they come across a new one, they are able to cope with any change. (MP3: 192-194)

Manoj's valuing of *basic skills* was also expressed through the way he utilised textbooks. He had observed that Australian textbooks often introduced a chapter through an investigative activity, as a sort of stimulus or rationale for learning the relevant concepts or skills to conduct the activity. Not surprisingly, Manoj believed that mathematics learning would be more effective if basic skills (and concepts) were introduced first. Thus, when Manoj used the textbook, his teaching would represent a re-ordering of the sequence of materials presented in the textbook, so that the investigative activity would be introduced after students had mastered the related mathematics skills.

Manoj's valuing of *basic skills* was also demonstrated through his marking of student work. In 13 of the 19 pieces of work collected, students received ticks for accurate plotting of points on the Cartesian plane (a 'basic' skill) for questions 7 and 8, even though they did not name the shape formed, as requested by the question (MA 14, 16, 17, 18(X2), 19(X2), 21(X2), 24, 25, 26, 29, 30, 31, 32) (see Figure 5.10 for an example). What appeared to matter, then, was the basic mathematical skills (of plotting points) the students were learning in that particular topic.

Figure 5.10.

The valuing of basic skills.
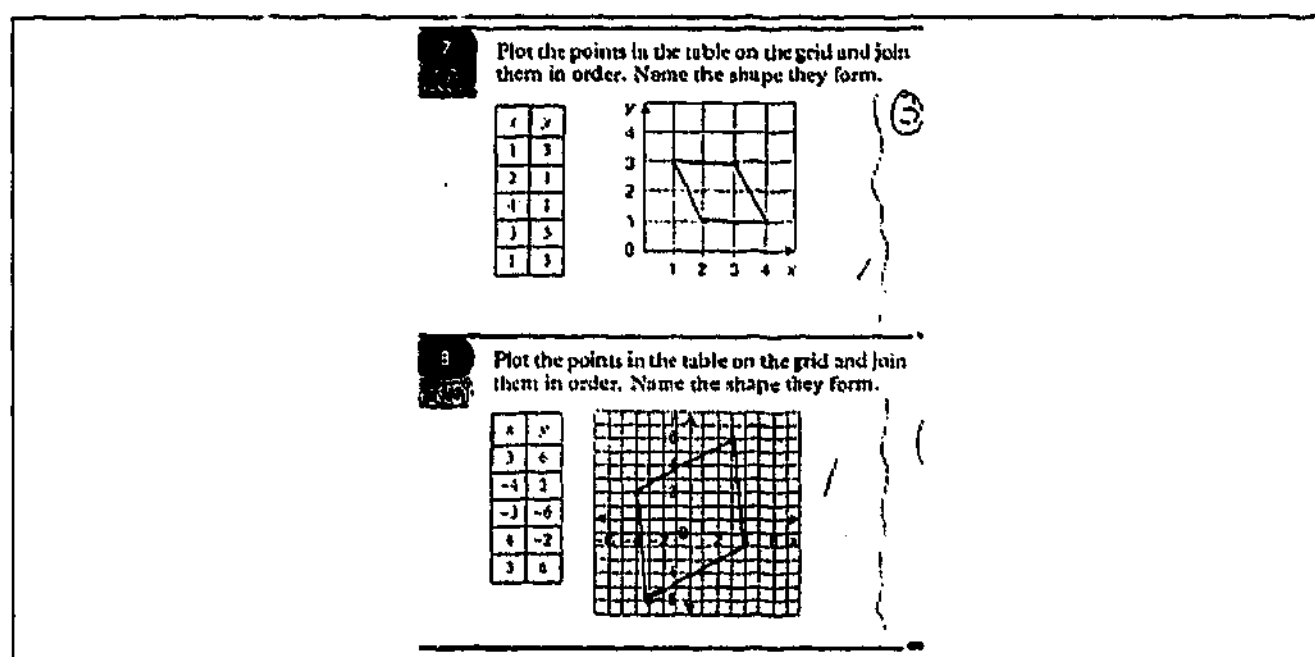
Similarly, in another question, Manoj appeared to only focus on students' ability to identify gradients of lines as either positive or negative, regardless of whether the students provided a reason, as required by the question (MA 14, 15, 16, 17, 19, 21, 24, 28). In fact, even if the wrong reason was given (MA 20, 22, 23, 25, 26, 27, 29, 30, 31, 32), a tick was still given, for stating the sign of the gradient correctly. Figure 5.11 illustrates examples of these.

It also appeared that Manoj's valuing of *basic skills* did not extend to notations. For example, two questions (questions 5 and 6) had asked for coordinates of certain points on

Figure 5.11.
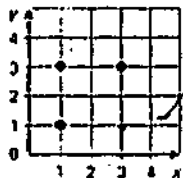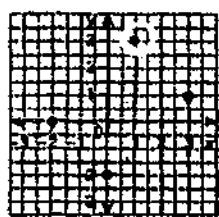
Affirmation for correct statement of the sign of the gradient, regardless of the students'
reasoning.

the Cartesian plane. Students who were able to find/locate the coordinates were awarded
with ticks, even if they had used the wrong notation (MA 24), or no notation at all (MA
17, 24, 25(X2), 30), as illustrated in Figure 5.12.

Figure 5.12.

Awarding students for demonstrating skill of identifying the desired coordinates.

5.5.2.4 Respect (General Educational)

In terms of general educational values, differences in the way in which Australia and Fiji were perceived to value *respect* (for teachers) were a source of dissonance for Manoj. In Fiji, it was important for students to accord teachers with respect (MC; MQ 44b). In Australia, however, Manoj felt that teachers and students were almost on equal footing in classroom relationship and interaction (MQ 44b).

For Manoj personally, he valued *respect* and he believed that it was one of the main values he portrayed in his class in Australia (MC). To him, the value would also be related to the quality of home education:

> I think the value of respect ... we always respect our elders without necessarily know [sic] why we still respect them. You know, my uncles and aunties, and etc. But, when we think about it, I think, yeah, it was a good value that those discipline was included .... Um, to me, that's important. To me, respect is important. You don't respect, you don't get anything out. (MP2: 278-284)

In this regard, Manoj was observed to be intolerant towards what he perceived to be student challenge to his authority. The following shows an example of such an incident in class, when Manoj reminded a student (Michael) of his authority as teacher and of his expectation that due respect be given to him:

Manoj:	(Manoj moved to Michael's seat, and talked quietly to him) You get up there, draw again, copy that table, and draw the graph.
Michael:	Why?
Manoj:	Because I'm asking you to.
Michael:	I'm doing this.
Manoj:	You copy that. Unless you do this, you won't be able to do anyone of those. Where's the graph? Do all the graphs.
(Michael protested)	
Manoj:	Then, you plot it from here. That's how you know whether you know it or not. Don't talk to me in that tone.
Michael:	I know. You talk to me —
Manoj:	No, no, don't talk to me in that tone. You talk at home, but you don't talk to me in that tone. Just don't do it, okay? You finish it, or you will be sitting here to do it. It's up to you. If you don't know, you ask me.

(ML3: 605-628)

In a sense, valuing *respect* facilitated the valuing of *authority* and *order*. These two related values were also emphasised by Manoj in his practice (e.g. ML1: 507-511, 519-520, 614-615, 619-620, 645-660, 716-719; ML3: 605-610, 691-732), and Manoj had also

talked about the importance of students valuing these (e.g. MP1: 227-230, 478-483; MP3: 70-78).

Perhaps due to the several incidents which led him to discipline 'rude' students like Michael, Manoj's valuing of *respect*, *authority* and *order* had helped to define the atmosphere of the class observed. It was one in which students sat in rows quietly throughout the lessons. In this sense, these general educational values were also expected to impact on the quality and nature of mathematics learning that took place in Manoj's classroom. Certainly, they also supported his valuing of *teacher-centredness* (Section 5.5.2.2).

5.5.2.5   Academic Achievement (General Educational)

Differences in the way the Australian and the Fiji Indian cultures valued *academic achievement* was another value difference inherent in Manoj's mathematics classroom. According to Manoj, a good education in Fiji was equivalent to a route to good jobs later on in life (MQ 12, 42b). As a result, students there were very dedicated to *academic achievement* (MQ 42b). On the other hand, Manoj perceived the Australian society as not placing as much importance in student achievement of school mathematics (MQ 13). Learning tended to be undertaken with an element of fun, and thus most students in Australia were not enthusiastic about learning and about schooling (MQ 42b, 43b).

For Manoj, education was important, not just for career prospects, but also for meeting demands in life (MP2: 295-297). While academic achievement might be an indicator of how successful a student had been in the education system, the years of teaching in Australia had led Manoj to recognise that this value needed not be the determinant of one's success in the Australian society. That is, while Manoj continued to portray his valuing of *academic achievement* in the Australian mathematics classroom, he had also cultivated a different understanding of its place in the society, and a view that expecting every student to excel in mathematics might not be good for all students:

Manoj: I think I have become more tolerant here. Tolerant in the sense that I have accepted that there are students who are not just in the top level, and that I have come to understand their shortcomings, in — whether mathematics, science or whatever. Hmm, I think I have become more tolerant of that. Whereas I don't think I was that at home. Now that I have become tolerant, I can see that, over the years, that yeah, it's not always right, it's bad for everybody ….

Interviewer: Can I say that over the years –

Manoj: I've mellowed (laughs). That's what it is. (MP3: 401-419)

In this process, Manoj had not taken on board values related to his perception that Australian (mathematics) classrooms emphasised *fun*. He elaborated on his evolving valuing of *academic achievement*:

Manoj: I think, as I say [sic], I think over the years, your own [teaching] style changes .... I have learnt to be tolerant, as I said, and to accept people as they are. I think we [in Fiji] were sort of [having a kind of] restricted way of thinking. I think here [in Australia] it's sort of what you call open-minded, slightly different.

Interviewer: But in your tolerance, in cultivating the tolerance, have you compromised any of your cultural –

Manoj: No. My expectation is still the same. I still expect the same .... Those who can get 90 should get 90, I don't think about it. But, yeah, in the lower quartile, yeah, if they can get 50%, 60%, I'm happy with that, because I know that's their limit. I accept that, and I value them that way. Not everybody is going to be 'A' students; some of them will be average students. But the emphasis is I have tried, the students have tried, [and they have done] done their best, got the best result as expected of her ability, or his ability. Now, I think that's an important thing I have learnt here. Because not everybody can become a doctor, and all that ... I always tell my kids, "look, you may not like this ... but there are something you must be good at. You should find out what it is. If you are good with your hands, you should realise ... your ability, because that will lead you into a fruitful, meaningful life. And you might be good at painting, you might be good at carpentry, you might be good at mechanical things. But that doesn't mean that you can't make a life out of ... your area of interest!" You know, some people may be very good at cutting, drawing things .... You don't have to be academic, you can be on the mechanical side of things, and I think that's very very important .... If you have kids in your class and they [are] sort of not doing very well in your subject, because academically they are not that inclined, there is no reason why the same child can't be doing something else, like art, or doing graphics, or doing drawing which they are very good at. There's nothing wrong about that. You have to utilise whatever ability you are best at. And I think that's very important. That's something also I have learnt over the years, isn't it? That's nothing wrong with it. Why not, you are good in this sort of work. I mean, you can see, it's your interest, or carpentry, or painting, ... mechanical work, you know .... This child of a friend of mine, he can take the whole model apart, put it all together. He can't read, but he can do it all. So, you know, you have to realise your own potential, where you are, where your strengths will add up. And that's something I have learnt. It doesn't have to be a white, clean job. You can do anything [as your career]. (MP3: 454-515)

5.5.3 Responsive Approaches and the Underlying Factors

From the discussion in Section 5.5.2, it was apparent that Manoj's response to most of the value differences he perceived was one of being culture-blind, that is, he did not feel the need to change his practice. As he mentioned, he did consider the relevance and suitability of the local values for effective mathematics teaching/learning (MP2: 310-311). Most of the time, however, his rationalisation would justify the continual

affirmation of the Fiji Indian values. We saw this in the value differences relating to *basic skills*, *teacher-centredness*, and *respect*.

Table 5.6

Value Difference Matrix for Manoj

Value difference	Nature [a]	Responsive approach	Contextual factors [b]
Basic skills	ME	Culture-blind	(+) Rote learning leads to understanding, which in turn leads to acquisition of basic skills useful later in mathematics and in life.
Teacher-centredness	ME	Culture-blind	(+) Student discussions are not effective.
Respect	GE	Culture-blind	(+) Important to respect teacher authority.
Relevance	ME	Accommodation	(−) Learning is to prepare students for life.
			(−) Provides students with motivation to practise basic skills.
Academic achievement	GE	Appropriation	(−) Different people have different potential.
			(−) Academic achievement is not the sole determinant of a student's success in education.
			(+) Utilise one's ability to her best.
			(−) Australian society did not value student achievement in mathematics.

Note. [a] The nature of value difference may be:

        mathematical (M),

        mathematics educational (ME),

        general educational (GE),

        organisational (O).

[b] Contextual factors may be:

        facilitating (+), aligned with the home culture value,

        constraining (−), aligned with the Australian value.

Manoj did embrace the Australian relative valuing of the *relevance* of school mathematics, for it supported his belief regarding the purpose of education, and provided students with the motivation to sharpen their basic skills. Other than this accommodation approach, Manoj also appropriated his practice for the value difference relating to *academic achievement*. In this instance, Manoj's interpretation of the value difference in the context of the Australian culture had probably interacted with his personal valuing of *personal best* in shaping his responsive approach. Furthermore, Manoj talked about

tolerance (see Section 5.5.2.5) as a means of explaining why he appropriated his practice. In a way, this related to his valuing of *conscience*; that he ensured that his conscience was clear (MP2: 44-47; MP3: 367) was Manoj's way of maintaining his sanity. He shared that he did not wish to go home at the end of a school day feeling upset and losing sleep as a result. In his words,

> you can take them [the students] to the well, but you can't make them drink unless they want to drink. So I mean, you can only do so much. (MP3: 372-374)

It is significant that despite his having been teaching in Australia for the past 27 years, despite years of opportunities to compare Australian values with Fiji Indian ones, and despite having negotiated value differences perceived during years of teaching in Australia, Manoj did not appear to have turned local, accepting and internalising what the Australian classroom valued in its context. Manoj's reflection in this study showed that his frame of reference for thinking about mathematics pedagogy remained very much to be based on his Fiji Indian values. There was evidently no total embrace of Australian values, at least not for those related to mathematics teaching and learning.

5.6 Rana

5.6.1 Introducing Rana

5.6.1.1 Personal Background

Rana is an ethnic Indian immigrant teacher of mathematics (RC). She was educated and teacher-trained in India (RC). The school she taught at in New Delhi was a Catholic school, as was her current school in Australia at the time of this study. Institutionally,

> it is very similar. I didn't find much difference. We have the same sort of teaching structure, meetings after school, social occasions, and emphasis on looking after the staff, access to international conferences. (MP2: 196-198)

Rana migrated to Australia with her family in 1985 from New Delhi, India (RC). Rana summed up the reasons for the move as follows:

> My husband's family is in Australia. Mine is somewhere in New York, I think. Scattered! So we decided to come to Australia, because it's such a great place, and more opportunities at the tertiary level, and jobs for the children. And that has turned out to be true. The kids have done well. They have gone on to university and to jobs. That we probably would have to put them in boarding school if we are back in India. (MP2: 205-209)

Rana did not start teaching in schools in Australia till 1989, that is, four years after arriving in Australia. She had spent the first two years of her teaching career here teaching in a South-eastern suburb of Melbourne, before joining the current school in

country Victoria in 1991 (RC). The move from metropolitan Melbourne to country Victoria was prompted by Rana's husband being offered a job in the area (RC). The family had since liked the way of life 'in the bush' (RC).

At the time of this research study, Rana had been in the current school for 10 years. She had been promoted to Director of Curriculum (RC). Accordingly, she was offloaded from classroom teaching commitments; the class observed (Year 12 Specialist Mathematics) was the only class she was expected to teach in the year when this study was conducted (RC).

Having been in Australia for more than a decade, and not having returned to India in the last few years, it was noteworthy that Rana frequently referred to current educational contexts and situations in India. According to her, the source of such information had been her friends. Through such contacts, Rana had been able to follow the major changes happening in Indian schools. At the time of this study, for example, Indian schools were experiencing much influence of the Western culture and its ideas, and were also introduced to computer technology (RC).

Speaking from personal experience and reflecting upon her professional interaction with immigrant teachers in her school, Rana singled out the first two months as being crucial for successful professional socialisation (RN4). During this period, it was especially more important that immigrant teachers knew and remembered students' names. Otherwise, there would be a risk of students playing up in class. As the school's Director of Curriculum, Rana had also been advising her newly-arrived immigrant colleagues to teach differently, if necessary. This included teaching flexibly (through stories and quizzes, for examples), teaching to motivate, and ensuring that rewards given out were deemed 'cool' by the students themselves.

Rana did not find teaching in her current school in country Victoria to be any different from teaching in a Melbourne suburban school (RC). However, she did find differences in schooling between Australia and India. An example was with regards to student attribution of failure:

> See, here in Australia, the students attribute their failure to others, like the teachers. In India, it is different: failure to perform would be blamed on destiny and on oneself. (RP3: 19-21)

Rana had also constructed a concept map for the purpose of this study, as her way of visualising aspects of differences in mathematics teaching/learning between Australia and

India (see Appendix 16). The concept map listed, for example, how parents in the two countries played different roles in their children's school education. Her observation was that Australian parents were more supportive of students' social life, imposed less pressure to — and lower academic expectations of— their own children, allowed their children to engage in part-time work when they were younger (e.g. Year 10), and possessed relatively less knowledge of available pathways in their children's education. While Indian parents might adopt efficient use of the fewer available resources, Rana also noted that Australian parents had not made good use of the many resources available around them (e.g. television, computer, internet) (RN4).

Rana had responded positively to my invitation to participate in this study. She supported educational research in general, and this study's focus on culture and immigrant teachers in particular. Throughout the period of study, Rana had been very eager and willing to share her experience. Despite her heavy administrative workload as the school's Director of Curriculum, Rana had not only volunteered to participate in this study, she had also set aside generous amounts of time for the preliminary conversation and post-lesson interview sessions (with the exception of the last interview session, in which she had to attend a meeting).

As hinted at earlier in this section, Rana had been playing an advisory role informally to colleagues who were newly-arrived immigrants themselves. At the time of this study, her school had just employed two more immigrant teachers of mathematics. They had arrived from Africa and Russia. Rana took the initiative to inform them about the current study and encouraged them to participate. According to Rana, she had highlighted to both teachers the academic importance and personal benefits of engaging in educational research. She was also interested to learn how different immigrant teachers of mathematics would socialise differently in the same school. Unfortunately, both the newly-arrived immigrant teachers felt that they were too busy coping with the first months of teaching in Australia, and both did not feel they were ready to participate in the study. Nevertheless, this episode highlighted Rana's positive attitude towards helping immigrant colleagues settle in, and towards educational research.

Overall, the relationship between Rana and me had been extremely friendly. On several occasions she had extended invitations to me to meet her family whenever I drop in at the vibrant country town in the future. She had also offered to collect for me any

information from India which might be useful for any of my educational research studies (RP1: 200-201).

5.6.1.2 Current School and Community Context

The school Rana was teaching in during the period of her participation in this research study was a multi-campus Catholic secondary college in a country town (RC). It attracted students from not just the town, but also from the surrounding regions. Most of these students belonged to middle-class families (RC). Class size was capped at 30 for the non-VCE students, and 28 for those in the VCE years (i.e. Years 11 and 12). This school was similar to the school Rana taught in India, in the sense that both were Catholic schools and both were not part of the government school systems (RC). Both schools were also well-endowed with facilities and both valued teacher *professional development* (RP2: 196-199, 239-249). For an immigrant teacher like Rana, this similarity between the schools had reduced the possibilities of culture shock when teaching in Australia (RC; RP2: 199-200).

The school's motto was 'strong mind, compassionate heart'. As such, the school emphasised teacher promotion of student *self esteem* (RC). In this regard, the school's programme included support for academically weak students, cross-age tutoring, and an emphasis on the pastoral component of a student's education. The school would also refrain from awarding the 'failure' grade to a student before attempts to help this student were exhausted (RC).

A recent dilemma facing the school had been deciding for or against the introduction of accelerated mathematics education for the more able students. On the one hand, the idea behind accelerated learning ran counter to Catholic teachings. On the other hand, the school had witnessed many able students who were not challenged, became disengaged, and subsequently under-performed in mixed-ability classes. In the end, the school chose to proceed with the introduction of the accelerated mathematics program (RC), a decision which was aligned with the school's valuing of student *self-esteem*.

The class observed was a Year 12 Specialist Mathematics class, the only class Rana was teaching that year. Out of the 10 students in the class, 9 were boys, and this lack of gender balance in the Specialist Mathematics class was often observed informally in schools elsewhere (the subject was commonly perceived to be the most rigorous amongst

the VCE mathematics subjects). Possibly also due to the nature of this mathematics subject, the students in the class were generally conscious of the need to achieve high scores and marks (RP1: 47-49).

5.6.1.3 Personal Values and Beliefs

In terms of her personal values, what stood out was Rana's emphasis on *professional development*, evident from Section 5.6.1.1 above. This was a value which had probably prompted Rana to volunteer as a teacher participant in this research study, and one which she tried to share with her colleagues who were themselves immigra ·t teachers of mathematics. This value had possibly accounted for Rana's support for educational research. In the following quote, Rana explained how this value had contributed to her professional health:

Interviewer: Do you feel challenged professionally?

Rana: Very much so (I: And enjoying it?) I enjoy it, but only because you're constantly researching new strategies, new methods. You're taking so many different things into account, de Bono, some current research, and you're talking to people and networks. It's very good. If you didn't do that, it will become still. You will be too focussed on your immediate class, results, class, results, keeping the course going, and that can kill a teacher. (RP2: 230-237)

5.6.2 Nature of and Responses to Perceived Value Differences

5.6.2.1 Process (Mathematics Educational)

Despite the similarities she perceived between the school she was teaching in Australia and the one she taught in India, Rana had also come across value difference situations in her Australian classroom. One of these was her observation that students in Australia appeared to place a lot of focus on right and wrong answers (RP1: 180-181). To her, Australian students were interested in quick fixes. If they appeared interested in knowing how to solve a particular problem, it was to serve the aim of getting an answer, and of getting marks (RP2: 163-164). Students in Australia appeared to Rana to be less interested in thinking about the process of doing mathematics. This was a source of dissonance for her, who had come from an educational system which emphasised thinking about the *process* (RP3: 38-39).

Rana considered this conflict between *process* and *product* as a differ·ence in emphasis between how to learn and what to learn. Her personal view was that the benefits

of embracing *process* would be more permanent in a student's life (RP2: 165-167, 188-191) and more motivating (RP2: 165-170). As she said,

later, when they use maths again, what do they learn through their Year 12? Or 1 year with a teacher like me? What will they remember of what they learn, or how to learn? So I try to do that 'how to learn' rather than 'what you learn', because I realise in my second or third year of teaching, that if I focus on 'how to learn', I automatically got the kids wanting to learn, because they are mentally successes [sic]. (RP2: 165-170)

Thus, in the classroom, Rana consistently demonstrated her valuing of *process*. She would direct her students to focus on, and to discuss the steps involved in solving mathematical questions (e.g. RL1: 65-73). Many times this might be recipe-like, with each step of the solution process clearly articulated (e.g. RL1: 128-132, 160-172). Rana might also write down the strategies used on the board, as a means of cultivating students' ability to articulate their solutions better (RP3: 38-41). She might also challenge students to think critically about particular steps (e.g. RL1: 94-98). At other times, Rana led students to focus on particular steps in the solution process, through representing with flowcharts (RL1: 195-196), identifying keywords or key-phrases (RL3: 25-41), or defining given conditions (RL1: 196).

Rana's valuing of *process* was also articulated through getting students to look beyond the correct answers for given mathematical problems. As shown in Figure 5.13, Rana did not want students to just find the correct answer; that would have reflected the valuing of *product*. Rather, students also had to provide reasons to explain why their choice would t : ʉⱴ answer, thereby emphasising the *process*. In addition, students were also challenged to identify and justify for the least incorrect answer, supposedly a commonly-committed error. This exercise was unique to Rana in this study of 8 teacher participants, and exemplified again her valuing of *process* in the mathematics learning experience.

Rana recognised that this valuing of *process* in one's teaching necessarily consumed a lot of time. Rana seemed to have worked round this by issuing less but carefully selected homework questions, and by getting the students to check the answers and solutions from the teacher solution book themselves (RP2: 170-182):

this I learnt three years after giving kids exercises, left-hand side, right-hand side, all that rubbish. But I was doing mathematics with them. (RP2: 179-180)

Figure 5.13

Teacher emphasis on process in assessment exercise.

5.6.2.2 Historical Context (Mathematics Educational)

Another perceived difference of what the Australian and Indian mathematics classrooms valued was *historical context*. In India, this was very much valued in mathematics education; students would often be shown how similar problems had been tackled in the ancient civilisations (RC). In fact, Rana shared a personal affinity to this

value as well:

> I'm very focussed on where things have come from, and why, and how we in those generation used them. So I always do things with the kids with the abacus, Arabic numerals, and a link with different things. (RP1: 105-107)

Thus, in her Australian mathematics classroom, Rana remained committed to encouraging her students to know the historical background to mathematics topics, and to be aware of how ancient civilisations dealt with problems related to these topics (RC). Her students played an active role in this, as explained by Rana:

> So what I do, I give them reading material, like we're working with differential equations, so they have the life stories of Bellouni and the rest of them, and they each pick one, and then when it comes to a certain point, they might refer to some of the work that Descartes or Bellouni have done, and relate it to us. So then they have to talk in class. (RP1: 88-92)

Rana considered this valuing to be an aid to facilitating student memory of the related mathematics, as students would often find it easier to remember mathematical knowledge if they could link this with episodes of what mathematicians or other people had done with them in the past (RP1: 92-94). Furthermore, there were the opportunities for students to establish connections between mathematics and other school subjects (RP1: 108-109). In Rana's view, the extra time which was invariably required to portray this value was well-worth the connections made, and the positive learning experienced, by the students (RP1: 95-96).

5.6.2.3 Conceptual Understanding (Mathematics Educational)

The Australian and Indian mathematics classrooms were also perceived to value *conceptual understanding* differently (RC). Rana felt that this value was emphasised much more in Indian schools. For example, the compulsory component of school mathematics there at the equivalent of Year 11 level would include geometry and formal proof. These two areas of mathematics did not appear to be as emphasised in Australian schools, if at all (RC).

While Rana recognised that she could not possibly make any change to these institutional factors, she did seize opportunities to encourage her students in Australia to develop depth in their understanding of mathematical concepts (RC; RP1: 117-119). For example, she was observed to have invested time to discuss with students the concepts behind given conditions in mathematics questions:

Rana: Can you have a look at 2(e) on page 217, and explain to us why that particular restriction has been placed on that function.

David: (Murmured a response)

Rana: Sorry, David?

David: (Words unclear)

Rana: Right, should you include restrictions like that in your answers?

Student: Yes.

Rana: Yes. If it is relevant and applicable, yes. Please use the restrictions in your answers. Okay, alright, use a pencil, write a note inside your book to remind yourself.

(RL1: 104-118)

In another instance (RL2: 37-67), Rana was observed discussing the number of significant figures required in the answer for a particular question. She went beyond informing students that a certain specified number of significant figures was expected in the examinations. Rather, Rana took the opportunity to explore with the students why certain number of significant figures were required for particular circumstances (RL2: 66-67). This provided students with a conceptual understanding of the role of significant figures in different mathematical contexts.

Conceptual understanding was portrayed in a different manner in Rana's Australian classroom, however. While she explained mathematical concepts through formal definitions when she was teaching in India, Rana recognised that the relatively lower level of competency in mathematical language amongst students in Australia meant that she had to foster *conceptual understanding* differently. She had been achieving this by way of illustrating concepts through examples, and guiding students to understand concepts in context (RP1: 119-120). Or, she might make use of chosen textual discourse to help students draw out the conceptual knowledge (RP1: 120-122).

5.6.2.4   Mathematical Language (Mathematics Educational)

As hinted to in the section above, Rana felt that her students in Australia were less competent in their command of mathematical language. She recalled that

at the start of the year, the boys [sic] would hardly say one or two words, but they could write pages. They just would not articulate, and they wouldn't say things like 'transpose'. (RP1: 113-115)

In Rana's opinion, however, the mastery and valuing of *mathematical language* were important for daily living and communication (RP1: 158). She had also noticed a boost in students' self-esteem and expressivity when they had acquired more of the language of

mathematics.

> Like Katrina for instance, she's very weak at maths. But here, she has enough confidence to move over, come up to the board, ask me things. In her [mathematics] methods class, not a word. The teacher says she is very far behind, she's not working, so that's a pity. (RP1: 168-170)

Thus, this was a situation which Rana felt needed to be changed, not least because a de-valuing of *mathematical language* affected her discourse to her students (as we saw in the section above, for example). However, instead of introducing mathematical terms formally (such as through definitions),

> I throw them [i.e. the mathematical terms] in. I don't give them as something at the start the lesson and they don't use it. I throw them in all the time, so they use it rather than learn about it. (RP1: 152-153)

The following is an example of Rana's discourse in her mathematics lessons, which encouraged students to learn and to use mathematical language in context:

> (A student walked up to the board to work out another problem while classwork was in progress)
>
> Rana: Okay, we are looking at 2(1), and this time, the difference is you're using initial conditions to solve. So you are not going to get a general solution; you are going to get a particular solution. So make a note about that.

(RL1: 83-88)

The inclusion of the term 'initial conditions' facilitated students to fully understand its meaning and its use, with Rana making explicit the context within which it was positioned with the cue, 'this time, the difference is'. In the next sentence, the use of both the terms 'general solution' and 'particular solution' effectively provided a contrast against which students might be able to remind themselves what the terms separately meant.

Rana, however, had not been able to demonstrate her valuing of *mathematical language* in all classroom situations in Australia. There were occasions when this value was in competition with *conceptual understanding*. As we saw in the section above, Rana would 'sacrifice' *mathematical language* to foster students' *conceptual understanding*. After all,

> I try not to use very rigorous terms. It means nothing to them [i.e. the students]. So I try and find an example, and then I said, "well, what concept is that?" And I might say, "look at paragraph so and so," I might say, "refer to paragraph so and so, check the third line, what word is in there that says what this concept is." .... Over the years I've seen that my expectations [of students' command of mathematical language] need to match what the students can produce, otherwise it's no good. So if I start up there, and then they are down there, the two will never meet. It's not much use. (RP1: 119-126)

As a result, Rana's level of portrayal of her valuing of *mathematical language* had been markedly lower than it was when she was teaching in India:

Interviewer: Do you think you use much more deeper mathematical language in terms of terminologies and conceptual terms in India in your teaching?

Rana: Absolutely yes, oh yes! This would be considered baby language, you know. This would be considered like skimming through a course.

(RP1: 128-132)

5.6.2.5 Groupwork (Mathematics Educational)

Here [in Australia], it's — we don't really care that you work with someone else to get your solution, provided you understand it. That's the attitude here. Over there [in India], it has to be yours, because you are going to be assessed on it. It must be some overt kind of answers. And you can't get help for — you must do it by yourself. That's a big difference. So group work is encouraged here. Group work is not encouraged there. (RP2: 106-110)

Rana's observation above outlined another mathematics educational value difference she had perceived in her professional experience in Australia. In a typical Indian mathematics classroom, students were expected to learn individually in class, and assessment policies there rewarded student individual effort. In Australia, however, there appeared to be a valuing of *groupwork* or *collaboration* in a student's mathematics learning experience.

Over the years of teaching in Australia, Rana had learnt to entrust students with the responsibility of their own learning, and part of that involved letting students engage in groupwork, albeit with "checks and balance in place" (RP2: 126-129). As she had come to realise, students could and did learn a lot when they reciprocated the trust that she gave them (RP2: 130-131).

However, Rana's introduction of groupwork in her lesson did not seem to imply that she had embraced the value of *collaboration* that was inherent in the norm of an Australian mathematics classroom. While she had found that students could be trusted with the responsibility to learn on their own in groups, this took the form of peer teaching rather than peer discussion. So, when Rana mentioned that she had replaced some of her direct instruction with opportunities for peers to teach one another (RC), such opportunities involved the more knowledgeable students teaching their peers. Even her provision for student contribution in class appeared to have been planned such that the more able students could reinforce the relevant topics in their own words; it was more of

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a way of facilitating knowledge transfer rather than open discussion of ideas (e.g. RP1: 72-75).

It appeared that Rana's adoption of peer-teaching in her class was a response to the students' lower mathematical standard. Getting the students to peer-teach one another would facilitate the teaching process, and which allowed Rana to "keep the standard going" (RP2: 125-126). In this sense, Rana had appropriated her valuing of *groupwork* in the context of local conditions, in a way which utilised selected aspects of groupwork to support her practice.

5.6.3   Responsive Approaches and the Underlying Factors

As suggested in the sections above, Rana's responses to value differences tended to be the culture-blind and appropriation approaches. These are summarised in Table 5.7, together with the corresponding contextual factors which were found to impact on Rana's attempts at negotiating these differences.

It may be noted from Table 5.7 that the 'cultural freeze' was a contextual factor that ran through the various value differences. Despite Rana's ongoing awareness of the latest development in the Indian (mathematics) education system, she had evidently been experiencing 'cultural freeze'; when discussing the value differences, her frame of reference was invariably the Indian education system within which she cultivated her professional and personal values. As we saw earlier, Rana had been aware that the contemporary mathematics education system in India was undergoing changes due to the influence of Western pedagogical ideas and of computer technology. If Rana had not been experiencing 'cultural freeze', her own values pertaining to mathematics, mathematics education, and education in general might have evolved together with developments in India, especially since it may be assumed that some of the Western influences on the Indian mathematics education system might be similar to what Rana had noticed about the Australian education system too. In turn, this would likely have meant different perceptions of value differences, and/or different ways of responding to them.

It was also interesting to note that the culture-blind approach needs not be relevant only in situations when contextual factors were all facilitating the relevant home cultures' values. In the case of valuing *process*, for example, there was the constraining factor of

Table 5.7

Value Difference Matrix for Rana

Value difference	Nature [a]	Responsive approach	Contextual factors [b]
Process	ME	Culture-blind	(+) Student self-esteem.
			(–) 'Cultural-freeze' awareness
			(+) Does not hamper student creativity.
			(+) Students can thus better talk about their solutions.
			(+) School-leavers bring method along with them, not content.
			(–) Teaching schedules
Historical context	ME	Culture-blind	(–) 'Cultural-freeze' awareness
			(+) Personal value.
			(+) Aids student memory.
			(+) Links mathematics to other school subjects.
Conceptual understanding	ME	Appropriation	(–) 'Cultural-freeze' awareness
			(+) Personal value
			(–) Students in Australia were weaker in the mathematical language.
Mathematical language	ME	Appropriation	(+) Student self-esteem
			(–) Conceptual understanding
			(–) 'Cultural-freeze' awareness
			(+) Important for daily communication.
Groupwork	ME	Appropriation	(–) 'Cultural-freeze' awareness
			(–) Trust.
			(–) Peer-teaching.
			(–) The local students' lower mathematical standard.
			(+) Maintaining the students' standards.

Note. [a] The nature of value difference may be:

    mathematical (M),

    mathematics educational (ME),

    general educational (GE),

    organisational (O).

[b] Contextual factors may be:

    facilitating (+), aligned with the home culture value,

    constraining (–), aligned with the Australian value.

teaching schedules, since emphasising this value required time. Rana was able to work round the hurdle presented by limited time, however, by a combination of prudent homework planning and efficient assessment of student work (as discussed in Section 5.6.2.1).

As for the remaining perceived value differences, each was associated with both facilitating and constraining contextual factors, and Rana had shown consistently an appropriation of what the two cultures valued. As was the case with the appropriation approach adopted by the other teacher participants, the contextual factors were likely to be interacting with one another on an ongoing basis, in such a way that the relative dominance of each factor over the other factors associated with the same value difference could vary in different contexts. For example, with regards to the difference in valuing of *conceptual understanding*, the extent to which Rana emphasised that appeared to be contingent upon the standard of mathematical language demonstrated by a class. The relative equilibrium in the valuing of both *conceptual understanding* and *mathematical language* would differ in different classroom contexts.

The discussion with the first four teacher participants would have familiarised the reader with the structure of the value difference matrix, that is, the different categories under which value differences might be classified, and the interpretation of responsive approaches in the context of the facilitating and constraining factors. Spatial constraints placed upon this thesis report have meant that the professional socialisation experiences of the next four teacher participants need to be summarised rather than elaborated. This will be facilitated by the value difference matrix as a means of organising and displaying the relevant points relating to the negotiation experiences of the teacher participants.

5.7 Betty

5.7.1 Introducing Betty

5.7.1.1 Personal Background, Values and Beliefs

Betty followed her Australian husband to settle down in a Victoria rural city in 1992 (BC), after having taught for two years in England. She had earlier grown up, attended school, and qualified as a teacher in England (BQ 2, 3). She had been teaching (mathematics) since her arrival in Australia (BQ 5), and one of her greatest impressions had been her observation that different aspects of her practice had become more laid-back

in Australia (BC). Furthermore, she also felt that sports was more emphasised in Australian schools (BC).

Betty listed the following as qualities she personally valued: *tolerance, choice, human rights, acceptance* (of others for who/what they were), and *respect* (for mathematics). She felt that the same values would be portrayed by her regardless of the country or culture she found herself teaching in (BQ 33). On the other hand, she also felt that value differences were best resolved by taking into account the school's ethos and culture, as well as the community's concerns (BQ 40, 41). In other words, the local culture would be reflected in the mathematics she was teaching and through her professional norms and practice (BQ 31, 32).

5.7.1.2 Current School and Community Context

Betty was teaching in a prestigious independent secondary school in a rural city in Victoria (BQ 7). Unlike most other immigrant teachers in this research study, Betty considered that generally 95% of her students shared the same, Anglo-Saxon culture as her. Most of the other students had come from Asian cultural backgrounds (BQ 9, comments). The state school she was teaching in while in England had been challenging to her in terms of student behaviour and organisational expectations, and it was understandable why she considered her current workplace a great place to practise in (BQ comments). The class observed for this research study was a mixed-ability, Year 9 mathematics class of 23 students (BNI).

5.7.2 Nature of and Responsive Approaches to Perceived Value Differences

The difference in the way the Australian and English mathematics educational systems emphasised *applications* was evident to Betty. Specifically, she found that there was "more emphasis on genuine explanation, investigation and applying skills in a 'real' context" (BQ 43a; see also BP3: 190-199) in the Australian mathematics curriculum. On the other hand, mathematics was often perceived in England as mostly facts and procedures to be memorised (BQ 43a). Betty attributed this difference to "more stable employment situation [in Australia, where] — differing skills [are] needed for employment and for education" (BQ 43b). Betty had not found any difficulty embracing the value of *applications* in her practice though, since she had always demonstrated to students the relevance of school mathematics, even while she was teaching in England

(BP1: 169, 207-215). Thus, in this sense, the *application* that was valued by the education system in Australia had also been valued by her, which implied that this might have been a source of dissonance for Betty while she was teaching in England.

The different school systems she had found herself teaching in across the two countries had also made explicit the difference in the way (administrative) *support* was valued and provided. Betty had been frustrated in England at the amount of record-keeping and other administrative tasks teachers like her had to involve themselves in. In her opinion, such tasks had made it difficult for her to see the 'big picture' (BC) in mathematics education. Her school in Australia, however, had been organised in such a way that the provision of necessary support for teachers was efficiently delivered, so that teachers had the opportunities to examine their pedagogies and reflect upon their practices from a wider perspective (BC). Again, while this represented a difference in the valuing of *support* for teachers between Australia and England, it did not represent any source of dissonance for Betty, since she was only too glad that her school in Australia was sharing her value.

One value difference that was perceived in Australia, though, related to Betty's perception that mathematics questions were solved differently in Australia and in England: a valuing of technology use in Australia, and an emphasis on algebraic solutions in England (BC). She was concerned that students (in Australia) might be using technology inappropriately, such as not knowing when to harness technology, and when not to, in the process of doing mathematics (BP1: 284-290). She was also mindful that some aspects of the *beauty* inherent in mathematics could not be appreciated when mathematics was solved with calculators (BP1: 280-282). However, Betty's valuing of *efficiency* had also meant that she was supportive of the time and effort saved with proper use of technology. *Efficiency* thus acted as a competing value against Betty's valuing of more algebraic, paper-and-pencil or mental solutions to mathematical problem (BP1: 265-267). As a result, Betty's practice in her Australian classroom reflected a situational emphasis of *technology*, that is, one that encouraged mental computation for simpler questions and responsible use of technology in more tedious calculations.

Relative to the other teacher participants in this research study, Betty's home country (England) can be considered to be the closest culturally to the Australian culture. Thus, one would expect Betty to report few or no value differences between the Australian and

English mathematics classrooms. Does Betty's reporting of three perceived value differences constitute fewer instances of such differences? Certainly, one may argue that the observed difference in the valuing of (administrative) *support* was probably the result of Betty's transition from a state school system that was probably under-resourced to a prestigious, independent school that was financially well-endowed. In other words, any teacher making a similar transition in Victoria would have also perceived the same value difference. However, the other two perceived value differences (relating to *technology* and *application*) were very likely rooted in differences in the two countries' educational systems, and both had the potential in that sense to create dissonance and even conflict in any immigrant teacher from England. The implication, then, appears to be that even though Australia and England might have shared certain parts of their respective histories, the inevitability of distance have probably led the two countries to develop their cultures along different paths. Even though there might be fewer opportunities for value differences

Table 5.8

Value Difference Matrix for Betty

Value difference	Nature [a]	Responsive approach	Contextual factors [b]
Application	ME	Affinity	
Administrative support	O	Affinity	
Technology	ME	Amalgamation	(−) Efficiency.
			(+) Beauty (of mathematics).
			(+) Student inappropriate use of technology.

Note. [a] The nature of value difference may be:
     mathematical (M),
     mathematics educational (ME),
     general educational (GE),
     organisational (O).
[b] Contextual factors may be:
     facilitating (+), aligned with the home culture value,
     constraining (−), aligned with the Australian value.

across Australia and England, the potential for such value differences to create dissonance and conflict was not necessarily reduced.

Another interesting observation arising from Betty's data had been that while the difference between what was valued by an immigrant teacher and by the host culture (Victoria) might lead to dissonance and thus affect the teacher's professional

socialisation, any perceived value difference between the home and host cultures needed not be seen to necessarily point to such dissonance. According to Betty, for example, the Australian and English mathematics education systems valued *application* and (administrative) *support* to different degrees, but these value differences which Betty identified did not threaten to affect the quality of her socialisation into the mathematics education profession: she had apparently valued these to the same extent as they were in the Australian mathematics education system.

This distinction implies a response to the perceived value differences that was not yet described by any of the five conceptualised approaches listed in Table 2.3. The accommodation approach may appear to fit the response best, and yet it is different because accommodation suggests a change in the way the immigrant teacher orders her personal values, whereas in this case with Betty, what was valued in the Australian culture had already been part of her personal value system. She was already valuing application and (administrative) support when she was practising in England. The term 'affinity' may more suitably describe the sense of identification immigrant teachers like Betty feel with the local values in such cases, and has been used to describe Betty's response to the value differences of (administrative) support in her value difference matrix (see Table5.8).

5.8 Khaliq

5.8.1 Introducing Khaliq

5.8.1.1 Personal Background, Values and Beliefs

Khaliq is a male teacher who had been educated and teacher-trained in Lebanon (KQ 1, 2, 3). He had taught mathematics in Lebanon for 10 years before migrating to Australia 15 years ago (KC). Khaliq spent some time in Australia initially completing English language courses (having taught in French while in Lebanon (KP2: 111-113)), and the last 9 years here had been spent teaching mathematics in schools (KC). Khaliq was regularly kept informed by friends of developments in the Lebanese educational system. He had also been visiting family members and teacher friends in Lebanon regularly. Remembering his first days in the Australian education system, Khaliq considered himself fortunate to be given opportunities to observe lessons for a few weeks prior to actual teaching. Even then, he remembered experiencing a feeling of being thrown

straight into the system without adequate support (KC). Thus, Khaliq was very supportive of my proposal of running professional orientation and induction programs for newly-arrived immigrant teachers (KC). He also recommended that these teachers start off as relief teachers first in different schools and different educational systems, so that they might be certain what kind of teaching environment best suits each of them individually and professionally (KC). On the whole, Khaliq felt that his contributions towards teaching and towards organisational matters had often been ignored (KP3: 135-137), and even in the few instances when his suggestions were adopted, his contributions were not acknowledged (KP3: 143-150).

In relation to teaching in a different culture, Khaliq valued *adaptation*, in the sense that both his teaching style and his pedagogical content had to reflect the Australian cultural values (KQ 31, 32; KP1: 90, 133-134; KP2: 19). In particular, he reflected that his responses to value differences normally incorporated the tenets of the school ethos, and the concerns and interests of parents and the community (KQ 41).

5.8.1.2   Current School and Community Context

At the time of this research study, Khaliq was teaching in an inner suburb, secondary college in the state educational system (KQ 7). About 40% of the students there are Muslims (KC) like Khaliq. Many students in that school came from low socio-economic status (SES) background families (KC). Furthermore, Khaliq felt that the school was acting as a sort of 'dumping ground' for at-risk or financially-poor students living in the area, as well as for students with behavioural problems from the neighbouring suburbs (KC). Khaliq attributed this to the prestige and popularity enjoyed by non-government schools in general, and an increase in the number of such schools in the area (including two large Islamic independent schools) in particular (KC). An additional concern for Khaliq had been his feeling that the school administration had not been able to cater adequately to the needs of the largely Islamic students in the school (KC). According to Khaliq, these factors had accounted for the generally low morale amongst his colleagues (KC).

5.8.2   Nature of and Responsive Approaches to Perceived Value Differences

In Khaliq's opinion, one significant way Australia and Lebanon differed in their mathematics education systems was the degree of emphasis on the *application* of

mathematical knowledge. In Lebanon, school mathematics was mostly facts and procedures which students were required to memorise (KQ14), and there was also less practical work (KQ43a; KA1). As a student, Khaliq had tried to find out the relevance of school mathematics in daily life (KC), beyond its role in the society as educational gate-keeper (KQ42a). None of his teachers and lecturers, however, was able to provide him with a satisfactory answer. In the meantime, Khaliq had developed a valuing for *concepts* in mathematics teaching/learning in Lebanon. It was after Khaliq had arrived in Australia that he saw for himself how school mathematics could relate so well to real-life (KC). His impression had been that "the curriculum is very practical and suitable to students' needs and helping students for further study or work" (KQ44a; KA1). Subsequently, his practice had become one that portrayed both the values of *applications* and *concepts*.

Australia and Lebanon also appeared to value *assessment* differently. A student in Lebanon was normally expected to go up to the board in class to solve posed problems when asked, and all students had the same chance to demonstrate their mathematical competence publicly (KP3: 14-15). In fact, a student's performance at the board could contribute towards her formal assessment (KP3: 80-83). In Australia, however, student fear of embarrassment was normally respected and valued, and thus teachers did not normally identify particular students to solve given problems on the board (KP2: 74-77). At the same time, Khaliq was aware of the emotional burden students in Australia were already carrying without his valuing of (public) *assessment* adding to this burden: he had seen many students who did not feel valued at home, and school was a place in which they might have any chance to prove themselves (KC). Thus, Khaliq appropriated his valuing of assessment: students were invited to volunteer to show the solutions on the board, and should a student encounter difficulty at the board, Khaliq would guide the student through.

Cultural differences between Australia and Lebanon had also meant that *respect* was valued differently in schools. According to Khaliq, respect for teachers in Lebanon was similar to what would be given to prophets (KC). Khaliq recalled an incident when a student-turned-fiancée to a teacher was visiting the school and she was reminded to address her fiancé formally (KC). This level of respect accorded to teachers in Lebanon might be related to the population's high regard to schooling (KN1). *Respect*, however, was valued weakly in Australian schools (KC), and parental respect for teachers was virtually non-existent. In negotiating this value difference, Khaliq appeared to be

asserting his demand for *respect* in more subtle ways, while acknowledging the various constraining contextual factors that were prevalent in the Australian classroom and society.

Khaliq also felt that there was generally a greater expectation for teachers in Australia than their Lebanese colleagues to value the *customisation* of their lessons to the students' needs and capabilities. In Lebanon, teachers were expected to cover the prescribed syllabus "regardless of what they [the students] like to be or regardless to [sic] their ambitions" (KP1: 95-98; see also KQ42c,d). In Australia, however, Khaliq sensed that teachers "have the chance, the resource to produce and deliver a curriculum which is suitable to students [sic] needs and community expectations" (KQ43d). Khaliq had to assimilate to the way the Australian education system viewed teachers' work; he had little choice, such as the ten lessons he had 'lost' that year to his mathematics class (due to the school's staging of several sports events) which he was expected to find a solution to himself (KN2).

Khaliq's value difference matrix is presented in Table 5.9. It can be seen how Khaliq's responses to the perceived value differences were expressions of the personal values he identified, that is, *adaptation* and *learning atmosphere.* In negotiating the value differences, he had acknowledged the values and beliefs that he perceived to be in operation in Australia, such as students' confidence and their negative emotional experience at home in the value difference relating to *assessment.* His responsive approaches had also reflected Khaliq's emphasis on maintaining a positive atmosphere in his mathematics classroom.

Table 5.9

Value Difference Matrix for Khaliq

Value difference	Nature [a]	Responsive approach	Contextual factors [b]
Customisation	GE	Assimilation	(–) Student career demands.
			(–) Need not necessarily prepare students for exams.
			(–) Support from school, community, state and/or national policies.
Applications	ME	Amalgamation	(+) Concepts
			(–) Relevance of school mathematics.
			(–) Student career/life demands.
			(–) Need to reflect the Australian cultural values.
			(–) No need to prepare all students for higher education.
Assessment	ME	Appropriation	(–) Confidence
			(–) Need to reflect the Australian cultural values.
			(–) Many students don't feel valued at home.
			(+) Assessment
Respect	GE	Appropriation	(–) Create/maintain excellent learning atmosphere.
			(–) Need to reflect the Australian cultural values.
			(+) Need to uphold the worthy values of home culture.
			(–) Relatively little respect for teachers in society
			(–) Relatively less importance placed by society on schooling

Note. [a] The nature of value difference may be:

    mathematical (M),

    mathematics educational (ME),

    general educational (GE),

    organisational (O).

[b] Contextual factors may be:

    facilitating (+), aligned with the home culture value,

    constraining (–), aligned with the Australian value.

5.9 Li Kang

5.9.1 Introducing Li Kang

5.9.1.1 Personal Background, Values and Beliefs

Li Kang is Chinese Malaysian by ethnicity (LQ4). Educated and teacher-trained in Malaysia (LQ 2, 3), Li Kang had taught for 15 years there before migrating with his family to Australia in 1988 (LQ 5; LC). The move was prompted by perceived unfair disadvantages in the Malaysian job market (LC). Throughout his stay first in country Victoria, then in metropolitan Melbourne, Li Kang had been teaching in schools (LC). In his opinion, he had been in Australia sufficiently long enough to not attribute his norms and practices as being characteristically Australian or Malaysian (LP2: 28-32). In other words, Li Kang believed that he had incorporated features and values of both Australian and Malaysian pedagogical traditions.

As far as the subject is concerned, Li Kang believed that mathematics was independent of culture, unlike English where different writing styles would reflect the underlying cultural differences (LC). In this regard, he felt that the teaching of the subject should also be culture-free, even though he valued (real-life) applications of mathematics (LQ B comments):

> Maths is universal. Worded questions should not be culturally biased, e.g. questions involving cricket, football (aussie rules) may be biased in favour of Australians or students who play in the sport. How in questions like probability, involving playing cards, if assumed that all students are expected to know what a 'pack of cards' are. (LQ A comments)

Li Kang considered himself a conservative teacher (LC). He had this impression because he felt that his view that students were becoming too reliant on calculators and technology was somehow out of step with the latest mathematics pedagogical practice. Similarly, Li Kang was also wondering if his valuing of the role of *practice* in mathematics learning had become inappropriate.

5.9.1.2 Current School and Community Context

The state secondary school Li Kang was teaching in was situated in a south-eastern suburb of Melbourne (LQ 7). In his opinion, less than 4% of his students share his cultural background (LQ 9). His school principal had been treating Li Kang very well and providing him with good professional support (LC). This had been very different from his experience with other principals, one in his previous school in country Victoria, and the

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other being the previous principal of the current school. Li Kang felt that these two principals did not give him any opportunity to teach senior level mathematics, or mathematics at all, even though he was trained to teach the subject (LC). He was never told of the reason either, although he suspected that it would expose him to teacher redundancy exercises of the time (LC). At the wider level, Li Kang had found himself professionally vulnerable as a result of a culture of blame in the (school) community. That is, students who did not perform in his class could always blame him, claiming that they did not understand his lessons. During his participation in this research study, the class observed was a Year 12 Specialist Mathematics class. Although 7 out of the 10 students in the class were not ethnically Anglo-Saxon, Li Kang did not think that would signal lesser value differences for him. After all, in his opinion, most of the students were born and raised in Australia anyway, so they would have come to class with habits and beliefs that reflected the Australian culture (LN1).

5.9.2 Nature of and Responsive Approaches to Perceived Value Differences

The relative emphasis on *technology* in Australian mathematics classrooms worried Li Kang, for he had noticed student over-reliance on calculators (LP2: 60-62, 152-154) and students' silly mistakes arising from improper use of calculators (LP2: 66-68). The competing value of (student) *self-esteem* probably accounted for his approach to assimilate *technology* into his practice, however. On the other hand, Li Kang's valuing of *self-esteem* had been cultivated in Australia, probably as a result of his feeling that students in his home culture might have also become more sensitive to self-esteem (LC), and of his desire to reflect Australian cultural values in his practice (LC).

It is worth noting again in Li Kang's case that despite an individual's awareness of the 'cultural freeze' phenomenon, his frame of reference in interpreting particular value difference situations appeared to position him as a victim of 'cultural freeze'. Even though Li Kang felt that students in Malaysia might have become more sensitive to the state of their own self-esteem (LC), his view on the sensitivity of his students in Victoria was nevertheless contrasted with his knowledge of how Malaysian students used to accept teacher criticism and comments:

> in a Malaysian school that is the difference, in a Malaysian [school] it does not worry me at all you know, I can just [say,] "can you answer me, can you answer me?" I say yes or no, they will say yes or no, you know. (LP1: 190-192)

Students in Australia and Malaysia were also felt to value *practice* (through homework, for example) differently. For Li Kang, it would not be easy to come across students in Australia who regularly completed a substantial amount of homework (LC). Thus, Li Kang felt that he had compromised in this aspect of mathematics teaching (LC), giving less homework as a result. In a related manner, Li Kang felt that the Australian (mathematics) education system did not appear to value *standards* as much as in Malaysia. For example, he observed that students who were not yet taught all the topics for a particular year level could still move up to the next grade in the following year (LP3: 46-49), even though it was unlikely that these students might have attained the minimum required standards. There were several contextual factors at the institutional and societal levels constraining Li Kang's efforts to ensure that his own students attain the appropriate competency, however, such as limitation of curriculum time (LP1: 346-349) and absence of streaming (LP1: 353-354; LP2: 107-110). All Li Kang could do in response was to appropriate the values, portraying his valuing of *standards* as best as he could, in ways which took into consideration these constraints. Thus, for example, Li Kang acknowledged the limited time in the curriculum for mathematics, but also expressed his valuing of *standards* by staging extra classes for students in his own non-teaching time in school (LP1: 71-72, 84-98).

It has also been interesting to note that Li Kang held the view that having been teaching in Australia long enough, his actions in class might not be characteristically Australian or Malaysian (LP2: 28-32). He believed that his professional practice had become reflective of values related to both Australia and Malaysia. This seems to be in line with most of the responsive approaches Li Kang was observed to have adopted during the research collaboration period, as shown in Table 5.10. His appropriation of the perceived value difference pertaining to *standards* would demonstrate practice that brought out features of both Australian and Malaysian related values, and in that way Li Kang's actions would not be seen to be characteristically Australian, nor Malaysian, in nature. He might have chosen to assimilate *technology* and (student lack of) *practice*, but his personal values relating to these two perceived value differences had not likely changed. Thus, for Li Kang at least, even though assimilation may be associated with a continual private embracing of values associated with the home culture, the individual assimilating the action might not be certain that this home culture value is not portrayed in any way subconsciously. Does this imply then that beyond the surface characteristics

associated with the host culture that are demonstrated through the assimilation approach, the home culture's values may be in some way discerned by others (e.g. the students) too?

Table 5.10

Value Difference Matrix for Li Kang

Value difference	Nature [a]	Responsive approach	Contextual factors[b]
Technology	ME	Assimilation	(−) Student experience of achievement / self-esteem.
			(−) Need to reflect Australian cultural values.
			(+) Technology is best introduced after skills are mastered.
			(−) Calculators introduced early on in the school years.
Practice	ME	Assimilation	(−) Need to adapt to local situation.
			(−) Students in Australia do not complete homework.
Self-esteem	GE	Accommodation	(−) 'Cultural-freeze' awareness
			(−) Need to reflect Australian cultural values.
Standards	ME	Appropriation	(−) Need to adapt to local situation.
			(+) Mixed-ability class.
			(−) Students may still move up one grade if they are not taught all the topics at current grade.
			(+) Demands of VCE at the end of Year 12.
			(−) Curriculum time limited.
			(+) Slower students expect teachers to teach to their level.
			(−) No streaming of students

Note. [a] The nature of value difference may be:

       mathematical (M),

       mathematics educational (ME),

       general educational (GE),

       organisational (O).

[b] Contextual factors may be:

       facilitating (+), aligned with the home culture value,

       constraining (−), aligned with the Australian value.

5.10 Saka

5.10.1 Introducing Saka

5.10.1.1 Personal Background, Values and Beliefs

Saka was born and educated in Ghana (SQ2-4). He left Ghana in 1979 after 6 years of secondary teaching there, and taught in Nigeria and Papua New Guinea over the next 19 years before migrating to Australia in 1998 (SQ5). He had earlier applied for further studies in Australia and the United States of America, and having heard a reply from Australia first (SP3: 326-328), made the move to Victoria with his family (SP3: 314-318).

Saka had come across as a quiet and obliging man. He appeared to be someone who would prefer to stay away from conflicts or confrontation. Although a Christian independent school was located nearer to his house, Saka had chosen to join the current Christian independent school instead, because he preferred to teach to a student population which was relatively small and relatively free of discipline problems (SC). This line of reasoning would fit his personality well. Consequently I had a sense that he had felt obliged to participate in this study when invited to, even though he was experiencing a very hectic daily schedule. This was reinforced by Saka's interview data, which were typically not as well elaborated upon as the other teacher participants'.

Saka regarded his teaching style as one which emphasised teaching through *direct instruction* and learning through *investigations* (SQ35-37). Groupwork was a pedagogical activity he consistently placed least value to (SQ35-37). The role of mathematics education in reinforcing religious values appeared to be a significant one for Saka, as illustrated in the following quote regarding the teaching of *faith*:

> Sometimes the connections [between doing mathematics and learning religious values] are very clear and you can make it. For example, when we are talking about faith, you notice that in maths we exercise a lot of faith. Pythagoras' Theorem says that the square of the hypotenuse is equal to the sum of squares on the two remaining sides. We accept this as a thing and when you are using it in calculations, it is faith. You believe in it and you work with it. So you can link it .... So if you want to explain what faith really is, maths can always offer good levels of faith. (SP3: 236-260)

5.10.1.2 Current School and Community Context

Saka was teaching in a Christian independent school in suburban Melbourne (SQ7). The school was known in the area for its emphasis on the religious aspect in education. In fact, teachers applying for a position in the school needed to furnish reference letters from their respective churches, so that the school could ascertain the candidate's religious faith

and ability to encourage and inspire students in their overall personal development (SN1). From Saka's perspective, all his students were different from him culturally (SQ9). The class observed for the collection of data was a small class of Year 11 Mathematics Methods, with an enrolment of only 4 students (SC) — a figure that was rather typical in that school.

5.10.2 Nature of and Responsive Approaches to Perceived Value Differences

Both Saka and the Ghana culture valued students' *initiative* during their (mathematics) learning process. Students with initiatives were expected to revise their work on their own (SP1: 96-105, 135-138), and to complete assigned homework on time (SP1: 267-270). This value, however, did not appear to Saka to be as emphasised in Australia. According to him, one possible factor might be that whilst mathematics was considered a 'do-able' subject in Ghana (SQ42a), the Australian students were perceived to view mathematics as a subject in which an individual simply does what she can (SQ42a). That is, mathematics achievement is constrained by one's ability. Another contextual factor, in Saka's view, was a valuing within Australia that success would come about from external factors (such as 'quality' teachers and 'cheat sheets') (SQ42b), especially when there were "policies [which] may encourage students to expect good results without making much effort" (SQ42d). Against these contexts, Saka appeared to have assimilated to the Australian custom. For example, even though he continued to value student *initiatives* in their own learning, Saka was observed revising a topic with his students (during one of my visits) by personally solving several questions on the board (SP1: 117-119). He had believed that the students would be too passive to try themselves anyway, even though the examinations was approaching (SP1: 298-300).

Another value difference perceived by Saka related to different ways of valuing *supervision*. In Ghana, the teacher could walk amongst the students during classwork, checking on individual student's progress (SP3: 50-53). The same, however, might not be said of Australian students. In fact, Saka had noticed that those students in Australia who had written little might feel nervous having the teacher looking over their shoulders (SP1: 169-170; SP3: 42-44, 55-59). Saka's response was to stop at a student briefly, move around the classroom quickly, then return to the student to check for progress. Not only did this response recognise the students' possible lack of confidence to display her intermediate solution to her teacher, it also reflected his continual valuing of *supervision*

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in monitoring student progress in mathematics learning. This would be considered an appropriation response, since he was valuing both *supervision* and *confidence* through developing a 'new' classroom practice rather than simply enacting distinct norms that portray the two values separately.

There was also a perceived difference of how *technology* was valued in Australia and in Ghana. It was apparently emphasised so much in Australia that over-reliance on calculators had seen the tool being used even for simple, basic computations like 5+7 (SP2: 140-141). While he could not stop his students from continuing to use the calculator, Saka would stress to them the importance of using it at the right time (SP2: 140-143). He might also remind them that more time could potentially be saved in contexts when calculators are not used (such as finding exact trigonometrical ratios (SP2: 131-136)). In other words, Saka's practice took the form of both allo∵.ing students to use the calculator, and emphasising to them the need to be prudent in its use, thereby demonstrating the amalgamation approach.

Saka's responsive approaches to the three reported value differences were assimilation, amalgamation and appropriation. Although they were different from one another, all three were reflective of Saka's choice to portray values related to the Australian culture. At the same time, those values from his home culture involved in the value differences were not rejected. For the amalgamation and appropriation approaches, these home culture values (such as *supervision*) continued to be embraced alongside the Australian ones. When he assimilated a weaker emphasis of student *initiative*, that assimilation had also meant that he continued to value *initiative* amongst mathematics learners, though his actions did not explicitly portray it.

If Saka's responsive approaches to perceived value differences were aimed at maintaining harmony in his Australian classroom, this would be reflective of his personality. As discussed earlier, Saka gave the impression of a person who sought to avoid conflict or confrontation in his life. Although Saka did not identify these as such, but values like *peace*, *obligation* and/or *amiability* might well be part of his personal value system, which in turn guided his approaches towards negotiating the perceived value differences. It is thus not surprising that approaches such as accommodation and culture-blind was not chosen, as each of these involves the rejection of values related to either the home or host culture.

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Table 5.11

Value Difference Matrix for Saka

Value difference	Nature [a]	Responsive approach	Contextual factors [b]
Initiative	ME	Assimilation	(–) Expectation of teachers to give.
			(–) Policies mean that good results may be expected without much learner effort.
			(–) Examinations not a motivating factor for students.
			(–) Not as important for students to do well in school mathematics.
			(–) Academic success is due to external factors.
			(–) Mathematics achievement is constrained by one's ability.
Technology	ME	Amalgamation	(–) Student reliance on calculator.
			(+) Continual exercising of brain is essential.
Supervision	ME	Appropriation	(+) Personally values *supervision*
			(–) Student lack of confidence
			(–) Lower level of knowledge and quality amongst Year 10 students.

Note. [a] The nature of value difference may be:

    mathematical (M),

    mathematics educational (ME),

    general educational (GE),

    organisational (O).

[b] Contextual factors may be:

    facilitating (+), aligned with the home culture value,

    constraining (–), aligned with the Australian value.

In the last chapter, what the 35 questionnaire respondents wrote about the nature of value differences perceived, the operating contextual factors, and their responsive approaches to negotiating these value differences, were discussed (Section 4.2). This chapter has focussed on similar themes with eight immigrant teachers of secondary mathematics. However, the on-site collection of data from the teacher participants introduced in this chapter has facilitated more in-depth observations and discussions with them relating to their perception of — and responses to — value differences. In this sense, living with the teacher participants through the perception, negotiation and discussion of value differences in the mathematics classroom provided valuable insights.

In the next chapter, we will re-examine these experiences *across* the 8 teacher participants, as a means of achieving further understanding of their socialisation experiences through comparing similarities and contrasting differences.

CHAPTER 6

DISCUSSION OF INDIVIDUAL TEACHER DATA

The experiences of eight immigrant teachers in negotiating and mediating perceived value differences in their respective secondary mathematics classroom in Victoria had been presented in the last chapter. This chapter aims to look across the different cases and address the themes that emerged as a result. Specifically, the sections of the chapter will be organised by the three research questions formulated in Section 2.4. These questions are:

1. What is the nature of value differences perceived by immigrant teachers in the Australian secondary mathematics classroom? In view of the hitherto virtual absence of value conflict research in mathematics teaching/learning, to what extent are the value differences perceived directly related to mathematics and its pedagogy?

2. What are the approaches adopted by immigrant teachers to cope with and/or negotiate perceived value differences as part of their own professional socialisation process? What are the underlying assumptions, and how might these approaches displayed in observable ways? To what extent have these approaches been reflected in the conceptualised model of teacher approaches discussed earlier (see Table 2.3)?

3. What are the operating contextual factors that interact to guide teacher choice of responsive approaches? In particular, what are the roles played by competing, overriding and second-hand values?

This discussion will also be dealing with aspects of proposing responses to the research questions. The emerging ideas that are evident in Section 4.2 and Chapter 5 have all foreshadowed the complexities that are potentially involved in offering answers to the research questions. As such, it is envisioned that single paragraphs of summarised responses will not do justice to making any adequate account of the professional socialisations experienced by the teacher participants. In this manner, then, the writings that will be developed in the rest of this chapter may be seen to constitute an extended response to the three research questions posed in Chapter 2, and listed again above.

6.1   Nature of Perceived Value Differences

It is useful for the purpose of reader interpretation of this study to clarify that while perceived value differences explicated how the home and host cultures emphasised values related to the chosen contexts differently, this by no means implied that any one of the two cultures did not subscribe to any of the values concerned. Thus, different mathematics educational cultures might value, for instance, *practice*, by which a teacher's decisions and actions were guided. Yet, because other cultural values might be reflected in particular situations in the mathematics classroom, the *relative* significance and emphasis of *practice* in one of these cultures might be compromised as a result. A value difference may thus be perceived, though from a more holistic perspective this did not mean that *practice* was not valued in any one of the cultures. Rather, the value difference was perceived, and dissonance experienced, because two cultures appear to value *practice* to different degrees.

During the fieldwork phase of this study with the 8 teacher participants, a total of 34 value differences were perceived and reported by them. These value differences were categorised by individual teacher participants and listed in Appendix 17. Of course, these 34 differences might have been presented alternatively as a list, or categorised by different sets of criteria (such as types of value differences, or types of responsive approaches). That a decision was made to present these by teacher participants is a recognition of these immigrant teachers' ownership of their respective socialisation experiences, and perhaps more importantly, of the legitimacy of anchoring these value differences to the very people who perceived them and to the context within which they were so perceived.

6.1.1   Categories of Perceived Value Differences

From this list of 34 value differences, it is evident tha⁺ the three categories of values identified by Bishop (1998) as possibly expressed in the mathematics classroom, namely, mathematical, mathematics educational, and general educational, were useful in describing most of the values which teacher participants perceived to be different and potentially in conflict. Likewise, each perceived value difference had been classified as mathematical, mathematics educational, or general educational. The rest of the values involved in the perceived differences, however, appeared to relate to organisational concerns, rather than being directly situated within the mathematics classroom. As a

result, an additional category was needed to more fully describe the range of perceived value differences observed. This will be introduced in Section 6.1.1.4.

6.1.1.1 Mathematical Value Differences

Mathematical value differences refer to those incidents when there is a perceived possibility, need or pressure for the immigrant teacher to portray mathematical values corresponding to the Australian culture, when the teacher's actions may otherwise be guided by mathematical values corresponding to her home culture. Of the 34 value differences reported during fieldwork with the eight teacher participants, only one of these pertained to the nature of (school) mathematics. In other words, across the countries and cultures represented by the teacher participants of this study, there appears to be relatively few differences in how the discipline of mathematics is valued. Specifically, the observed mathematical value difference pertained to *precision*. Interestingly, with regards to her valuing of the precise nature of school mathematics (language), Deanne expressed the view that the Canadian emphasis on the value might be due to the 'old school formula' that ran through both her school education and the culture of the school system in which she taught. That is, there was the possibility that the focus on *precision* of mathematics might have become weaker in Canada as well over the period she had migrated to Australia.

Thus, it appeared that values related to the mathematics that the teacher participants knew in their respective home cultures were no different from the values that were inherent in the discipline of mathematics in Australia. It was as though the discipline was a constant and coherent entity across cultural borders. This phenomenon had been observed despite literature evidence of the socio-cultural nature of mathematics as a scientific discipline (Section 2.1.1), which emphasised the different mathematics*es* that developed in different cultures as these cultures confronted their own needs and made sense of the environment within which they situated themselves. Indeed, the teacher participants' experience recorded in this study and the ethnomathematics movement discussed in Section 2.1.1 seem to indicate the presence of a pan-cultural mathematics discipline that presented itself in all cultures, ethnic or otherwise, and that which is often taught in schools in these different cultures. That different ethnic cultures had contributed to the development of 'real' mathematics (Bishop, 1990; Joseph, 1993) might in fact serve to reinforce the pan-cultural nature of this conception of mathematics, which

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Bishop (1988) had referred to as M (against m for the ethnomathematical knowledge). The ongoing contribution to this form of knowledge by mathematicians from different cultures today may suggest that this M continues to develop free of any flavour of ethnic cultures. However, this is not to imply that M is culture-neutral. It has its own set of mathematical values (such as the three complementary pairs identified by Bishop (1988), and listed in Section 2.2.5), and it may well be that the preservation or development of these values are being regulated by a group of mathematician gate-keepers. These may be in the form of prominent voices at academic mathematics conferences who debate the relevance or validity of emerging mathematical theorems or proofs. They may also be in the form of authoritative pens of the editorial boards of academic mathematics journals, which influence what get published and what do not. There are also the referees and sponsoring corporations for mathematics research funding agencies, and these may signal ideological or commercial implications developed along particular directions. Unfortunately, the relative affluence of Western funding agencies has meant the possibility of this pan-cultural mathematics being identified with Western mathematics as a result.

This is thus possibly the scientific discipline of mathematics that has been introduced to different parts of the world, either through its association with the Western civilisation, through the political, commercial or religious colonists past and present, or through educational aid projects initiated by agencies such as UNESCO, the World Bank, and AusAID. In so doing, there is a perception that there is one 'real' mathematics, and the different ethnomathematics can somehow be regarded as relatively primitive and thus become marginalised. This 'real' mathematics belongs to the category of hard sciences, free from the socio-cultural subjectivities that may be characteristic of the softer, social sciences such as the languages, history, and geography. The positioning of mathematical studies departments in tertiary Faculties of Science certainly reinforces such views. In turn, students of mathematics, and thus the general population, acquire an internally-consistent set of mathematical values, that becomes immune to cultural differences when an individual functions across cultural borders, as the eight teacher participants' professional socialisation experiences has demonstrated.

6.1.1.2 Mathematics Educational Value Differences

If the mathematics discipline and the school subject of mathematics were considered by the teacher participants to be culture-neutral, the reporting of mathematics educational value differences implied that the way this knowledge is learnt and taught is not. In fact, the category of mathematics educational value differences was most commonly reported by the teacher participants. Twenty-three of the 34 value differences examined amongst the 8 teacher participants had been mathematics educational in nature, where the source of difference and the potential for dissonance and even conflict arose from perceptions of different ways of mathematics teaching, and by extension, different views of mathematics learning.

How mathematics teaching/learning was valued differently in different cultures was observed to express itself in different aspects of the curriculum, that is, intended, implemented and attained. In terms of the intended curriculum, there were instances when teacher participants reported value differences that were evident between the curriculum frameworks of their respective home cultures and the CSF operating in Victoria. For example, in the value difference relating to *conceptual understanding* that was perceived by Rana, she noted how this value was more emphasised in India through the inclusion of formal proof in the Indian curriculum statements, whereas this form of explanation was not evident in the CSF. Value differences were also observed in the implemented curriculum, such as in Manoj's observation that similar mathematics content might be delivered in Fiji in ways which were more teacher-centred than in a typical mathematics classroom in Victoria.

Aspects of the nature of the attained curriculum might also be valued differently in different educational cultures. Student learning, for example, appeared to be evaluated in different ways, thereby demonstrating different values relating to assessment (an aspect of the attained curriculum), as was reported by Deanne in her reflection of her teaching experience in Canada. There, there was a focus on formal *examinations* and *tests* as a means of assessing student learning. In Victori   vever, she had noticed a valuing of *alternative assessment*, in which student progr   .as evaluated through such means as extended projects.

6.1.1.3 General Educational Value Differences

The mathematical and mathematics educational value differences discussed above are certainly directly related to how different aspects of the discipline of mathematics, the school mathematics curriculum, and the pedagogy of school mathematics were perceived by the teacher participants to have been valued differently in the Victorian mathematics classroom when compared to their respective home culture sites of professional practice. On the other hand, cross-cultural value differences which were related to more general educational aims were also reported by 5 of the teacher participants. A total of 8 such incidents were reported by these teacher participants.

Amongst these reported differences that were related to general educational values, it might be seen to be significant that half of them were experienced by multiple teacher participants. Specifically, *power distance* was observed to be valued differently in Australia by Carla (Romania) and Deanne (Canada), while *respect* appeared to Manoj (Fiji) and Khaliq (Lebanon) to be valued differently in Australia. Notably, the relative emphases of these in Australia were similar across teacher participants, even though the teachers involved had come from a diverse range of cultures. That is, the mathematics classroom in Victoria, and by extension, the Australian society appeared to these teachers to be valuing *power distance* or *respect* less than in the teachers' respective home cultures. In fact, in Hofstede's (1997, Table 2.1) survey of 53 cultures, Australia ranked 13th in terms of cultures with low power distance, behind Great Britain and the Scandinavian nations. In particular, Canada (Deanne's home culture) has a higher power distance index than Australia, whereas Romania (Carla's home culture) was not surveyed in Hofstede's study.

Deanne's experience with the use of Canadian mathematics textbooks, and her subsequent perception that the Australian mathematics textbooks did not appear to explicitly promote *diversity* were significant, given that both Australia and Canada are amongst the most multicultural societies in the world today. It is likely that the rate of demographic changes to the contemporary Australian society is not complemented by a corresponding 'trickling-down' effect to the individual Australian of the country's commitment to *multiculturalism* or *diversity* in the major Australian cities. Further, Deanne's observation implied that little or no attempt was made to cultivate such (general educational) values in the young through school mathematics education. On the other

hand, the current federal government policies relating to the 'stolen generation' of the Aboriginal Australian population, its response to 'illegal' boat immigrants, and its hardline approach to global and regional terrorism, have all served to reinforce ideas of selective diversity and fear of (ethnic) differences in the community.

6.1.1.4 Organisational Value Differences

This study has also found that the values that were apparently underlying perceived differences were not always deriving directly from the mathematics classroom. As was mentioned in Section 5.4.2.5, values which were emphasised at the organisational level (such as school values) could be brought to bear in the context of the immigrant teachers' decisions and actions in the classroom, resulting in value differences being perceived. The source of these organisational values may be evident if educational systems are regarded as social institutions, which traditionally embody the values and norms of the very people who design and structure them (Bruner, 1996) – politicians, and to a certain extent, stakeholders such as educational boards (for example, in Victoria, the Victorian Curriculum and Assessment Authority), school councils, as well as the relevant professional associations and unions. In fact, they

> specify more concretely what roles people play and what status and respect these are accorded — though the culture at large expresses its way of life through institutions as well. (Bruner, 1996, p. 29)

Specifically, both the organisational value differences reported by two of the teacher participants related to differences in the level of support that was available for these professionals, although the type of support in each case was different. For Deanne, this was about a perceived lower level of emphasis on *professional support* in the Australian mathematics classroom, relating to teaching resources such as textbooks and professional journals, as well as to the different ways in which department meetings were conducted in Australia and in Canada (see Section 5.4.2.5). As for Betty, she noticed a relatively greater emphasis in Australia of *administrative support* that was offered to teachers. Clearly, these two types of support had one or more educational institutions as the source, such as the ministry of education and/or school. In this way, then, the nature of the valuing of these has been labelled 'organisational' in this study. In terms of the immigrant teachers' socialisation, the perception of organisational value differences impacted on the teachers' classroom practices, as demonstrated through Deanne (Section 5.4.2.5) and Betty's (Section 5.7.2) accounts.

6.1.2 Teacher Sensitivity to Perceive Value Differences

It has been interesting to observe in this study that value differences were not perceived by immigrant teachers from non-Western cultures only, as might be possibly expected by some. Amongst the teacher participants in this study who reported a total of 34 value difference incidents, there were two immigrant teachers from Canada and England, who were also perceiving value differences like their colleagues from other cultures. For instance, for Betty who had come to Australia from England, these value differences have been — and continued to be — perceived during her professional practice as a teacher of mathematics, that is, despite the fact that the wider Australian society has its roots in the English culture historically.

It is likely then that just like their carrier agent, language, cultures develop along different paths regardless of how close they might have been in the past. In doing so, cultures placed different emphases and values on comparable aspects of thinking, feeling and acting. That there is no banding or categorisation of the cultures surveyed in Hofstede's (1997) value continua (see Section 2.2.1) supports this notion that no two cultures share similar values consistently in different aspects of their functioning. Significantly, the internalised nature of values imply that if even immigrant teachers of secondary mathematics from England could perceive value differences in their professional socialisation experiences in Australia, they are as likely as immigrant teachers from other cultures to experience difficulties, conflicts or dissonance in almost all aspects of their (professional) lives. In other words, there is a need to guard against misconceptions that immigrant teachers from 'Western' cultures should have inconsequential or no encounter with value differences in the mathematics classroom of other 'Western' cultures.

It was also evident through this study that irrespective of the number of years the teacher participants had been practising in Victoria, value differences continued to be perceived as the student, classroom, institutional and social contexts changed with time. That these value differences remained related to the teacher participants' own home values suggest that as long as each immigrant teacher retains part of her home culture's values, perceived value differences will likely remain to be a facet of her professional socialisation and professional lives in the Victorian mathematics classroom. Thus, there has been no evidence in this study that teacher length of stay in Victoria might be a

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measure of an immigrant teacher's disposition or sensitivity to perceive value differences in their practice. Clearly, there are implications here for the fine-tuning of existing mentoring or professional development programs for immigrant teachers and their colleagues. For example, there may be a need for such programs to raise awareness that value differences between cultures may still impact on the practices and norms of teachers who might have immigrated to Australia 10 or 20 years prior.

Certainly, teaching experience which may be expressed through length of stay would probably have provided immigrant teachers with multiple opportunities to hone their responsive approaches to particular value differences. The certainty and confidence with which Manoj talked about how he dealt with perceived value differences was likely the manifestation of 27 years of teaching mathematics in Victoria. On the other hand, immigrant teachers who had demonstrated a keen awareness of value differences in their practice and an empowered ability to negotiate these were not necessarily teachers who had been 'veteran immigrants'. Carla was one such immigrant teacher amongst the teacher participants, whose 5 years of teaching in Victoria placed her as being the second youngest immigrant teacher in terms of teaching experience in Australia.

The discussion in Section 2.2.1 has perceived values as shared meanings of cultures, which helped to frame this study in the perspective that the immigrant teachers' personal value systems were first cultivated i their younger years in their respective home cultures. The strength of this internalisation of values in an individual's personal value system was certainly evident from the data collected in the study, for the value differences perceived by the immigrant teachers were clearly referenced against what were valued in their respective home cultures. Even for Manoj who had been teaching in Victoria for 27 years after leaving Fiji, day-to-day classroom interactions with his students remained to be interpreted against the Fiji Indian values with which he grew up. In this light, value differences were construed in Chapter 2 as being situations with the potential to lead to dissonance and conflict.

Betty's perception of value differences relating to *application* and *administrative support*, however, has also reminded us that not all perceived value differences present themselves to be affectively negative. While Betty recognised the differences in the valuing of *application* and *administrative support* between the education systems in Victoria and England, she was already identifying herself with how these qualities were

valued in the Australian classroom, rather than subscribing to a lesser valuing of these which Betty related to the English educational culture. In both these cases, the perceived value differences were sources of professional consonance for Betty, because her own values were aligned with the Australian culture. Betty might have been socialised to value *application* and *administrative support* to the same degree as the E *lish* culture, but evidently during her teaching experience in England, her values relating to these had been modified. As discussed in Section 2.2.4, value change in an individual accompanies life experiences, and it was likely that Betty's professional practice in her school in England might have stimulated a modification of how she valued *application* and *administrative support*, even though these changes had placed her 'on the outer' as a result. In fact, it is likely that these two value differences might have caused Betty some dissonance in England!

Thus, the findings of this study have not only validated current literature regarding values formation, they have also demonstrated how our knowledge of values change may be related to that of values formation to explain how perceived value differences need not always imply a potential for dissonance.

Values change amongst immigrant teachers after they have arrived in Victoria could also take place, such that the teachers' approaches to these value differences might be affected as a result. Manoj made reference to this in his appropriating the value difference relating to *academic achievement*. The quote below demonstrates a change in his valuing related to acceptance of people as they were, with the consequence that it impinged upon his responsive approach to the value difference:

Manoj: I think, as I say [sic], I think over the years, your own [teaching] style changes .... I have learnt to be tolerant, as I said, and to accept people as they are. I think we [in Fiji] were sort of [having a kind of] restricted way of thinking. I think here [in Australia] it's sort of what you call open-minded, slightly different. (MP3: 454-461)

6.1.3   Value Differences as Relative

The five Hofstede's (1997) value dimensions were introduced in Section 2.2.1. As demonstrated by the continua of value dimensions, a particular country or culture may be perceived to value a particular attribute more than another country or culture, but at the same time less than a third country or culture. Thus, we saw how Deanne perceived the

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Victorian education system as valuing *professional support* less than the Canadian system, whereas Betty was very happy to find the Victoria education system emphasising the same value more than the system in England.

Beyond this organisational value difference, however, it was not evident from the data that this relativity holds for any other perceived value difference in the context of the Victorian mathematics education system. That is, when Rana reported that Victoria did not emphasise *historical context* as much as the Indian school system, there was no evidence in this study of any other country's educational system which valued *historical context* less than in the Victorian classroom. Amongst the 34 value differences perceived and reported by the eight teacher participants, however, what appeared to emerge was a sketch of a mathematics education system in Victoria with distinct and unique features. These features will be discussed in the last chapter.

6.2 Teachers' Responses to Perceived Value Differences

The unique features of the mathematics curriculum in Victoria had certainly contributed to the immigrant teachers' perception of differences between cultures in the valuing of mathematics, mathematics education, and education in general. Faced with these perceptions in their respective mathematics classrooms in Victoria, how did the immigrant teachers respond to them? What were the teachers' responsive approaches to mediating and negotiating these value differences?

6.2.1 Responsive Approaches Adopted

As is evident from Chapters 4 and 5, different approaches were adopted by the immigrant teachers in their own negotiation of different value difference situations. Any one immigrant teacher has been observed to adopt a variety of responsive approaches towards the negotiation of different value differences perceived in her practice, a phenomenon which was also reported in studies, such as those conducted by Chew and Lim (1995) and Fast (2000) (see Section 2.3.2). In addition, the immigrant teachers in this study have demonstrated that in practice, the same individual may adopt different approaches in response to different contexts within which any one particular value difference was perceived. These approaches were found to be adequately differentiated with the five conceptualised approaches to negotiating value differences, as discussed in Section 2.3.2, and as tabulated in Table 2.3. As mentioned in this earlier discussion, the

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conceptualised model was aimed at establishing a framework with which the experiences of the immigrant teachers could be understood. That is, while observed teacher approaches were compared against the five categories encapsulated in Table 2.3, there were consistently conscious efforts against 'forcing' individual teacher approaches to fit any one of the five categories, and there was explicit awareness of the need to identify hitherto unaccounted-for responsive approaches, if any. As a result, Betty's affinity to two Australian values was documented, as was Carla's sense of helplessness in resolving one of the value differences she perceived in her mathematics classroom in Victoria. These responsive approaches will now be discussed in turn.

6.2.1.1 The Culture-blind Approach

The culture-blind approach refers to a teacher response in which the teacher's assessment of the difference in values resulted in the teacher's continual valuing of mathematics, mathematics education, or education in a way that is characteristic of her home culture. The introduction of this responsive approach in Section 2.3.2 was guided by Bishop's (1994) conception of it as an action reflecting an individual's unawareness of cultural difference. In our study, for each of the eight incidents (adopted by four of the teacher participants) in which values related to the respective home cultures continued to be espoused, it appeared to take place amidst an awareness and acknowledgement of differences in the way Victoria and their respective home cultures were seen to emphasise certain values, although in some of these cases the teachers had found it a challenge to explicitly articulate what the Victorian mathematics education system or the wider society valued. An example of this was Carla's negotiation of differences related to her valuing of *proof*. She was unable to account for the relatively less emphasis on mathematical *proof* in Victoria. She did not appear to have identified aspects of the Victorian education system which might explain, for example, her perception of this aspect of trivialisation of the discipline of mathematics. She just "found that stupid. I can't see the point in there" (CP3: 276). But, nevertheless, Carla was able to recognise a difference in valuing arising from cultural difference, and subsequently responded to it to restore a sense of affective equilibrium within herself.

In this regard, the use of the label 'culture-blind' to describe this responsive approach may be misleading. As explained above, the individual adopting this approach affirming relevant home cultural values appeared to be well aware of differences between cultures.

That is, the immigrant teachers certainly did not appear to be oblivious of— or blind to — cultural differences. Perhaps, a change in the labelling of this approach from 'culture-blind' to 'status quo' may be more appropriate in describing this nature of the teachers' approach to negotiating perceived value differences. That is, the 4 teacher participants in this study who adopted the status quo approach in the 8 reported incidents chose to maintain the status quo of the particular teacher actions or dispositions, in the same way that mathematics teaching would be facilitated in similar contexts 'back home' in their home cultures.

One might expect the status quo approach to be associated with relatively newly-arrived immigrant teachers, since continued experience in the host culture should sensitise a teacher's personal value system to a greater alignment to the host culture. Yet, for Manoj who had been teaching in Victoria for 27 years, he was observed to continue to demonstrate the status quo approach to several of his perceived value differences.

Does the status quo approach correspond to situations when the contextual factors were all facilitating the teachers' continual valuing of qualities associated with their respective home cultures? As the data showed, this might be the case for most of the value differences that were responded to with the status quo approach, but Rana's experience with *process* demonstrated that a determination to validate the home culture value could overcome any constraining factor, even if it might be imposed at the institutional level, such as that of the teaching schedule which Rana experienced.

6.2.1.2   The Assimilation Approach

When an immigrant teacher responds to a perceived value difference with the assimilation approach, she is acting in ways which affirm the Australian value whilst her value schema remains committed to the home culture value that is in conflict with the Australian value being portrayed. This approach was observed in 4 value differences perceived by 3 teacher participants in this study.

Examining the personal background and values of these 3 teacher participants, it might be possible to suggest why their actions did not reflect what they actually valued in these 4 cases of value differences. Amongst all these 3 teacher participants, none adopted the status quo approach in the other value differences each perceived. It is thus likely that these immigrant teachers had the disposition to avoid emphasising their home culture's

values in instances of perceived value differences. They might, however, accommodate, amalgamate or appropriate, as they did for the other value differences they perceived. That is, for these immigrant teachers, it appeared that they might prefer to assimilate rather than to negotiate value differences with the status quo approach. After all, Khaliq personally felt it important to reflect the Australian cultural values in his teaching style and pedagogical content (KQ 31, 32; KP1: 90, 133-134; KP2: 19). As for Li Kang, his assimilation response for the value difference of *technology* might reflect the effect of the competing value of (student) *self-esteem*, but in relation to the other difference to which his response was one of assimilation, which was related to the valuing of *practice*, it might be plausible that as an ethnic Chinese, a personal valuing of *collectivism* might have prevented Li Kang from emphasising only the value he subscribed to. For someone who values *collectivism*, the approach towards relationships has been to maintain harmony and to avoid direct confrontations (Hofstede, 1997). Saka's assimilative response to the difference in the valuing of *initiative*, on the other hand, appeared to have been an expression of his concern that insisting on emphasising *initiative* in the Australian mathematics classroom might be a futile attempt anyway (Section 5.10.2). Thus, the 3 teacher participants had different reasons for selecting the assimilation approach, although for the same reasons, the status quo approach was not selected instead.

6.2.1.3   The Accommodation Approach

The accommodation approach to negotiating perceived value differences involves the teachers embracing Australian values at the expense of the home culture's values with which they were perceived to be in conflict. A resolution of value differences through this approach is evidenced by the affirmation of the Australian culture in the teacher's planning exercise and classroom decisions. In this study, 5 instances of the use of this mode of negotiation were reported by 4 of the teacher participants.

Amongst these 5 value differences to which the accommodation approach was applied were 2 instances relating to a perception of the de-emphasis of *power distance* in the Victorian mathematics classroom. This was perceived by Carla from Romania, and Deanne from Canada. The relatively low power distance observed in the Victorian educational context was apparently reflected in the wider society as well; according to

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Hofstede's (1997, Table 2.1) survey, Australia ranked 13th lowest in terms of power distance amongst 53 participating cultures.

In relation to this approach to negotiating perceived value differences, it is remarkable that one of the questionnaire respondents seemed to have embraced the Australian values and way of life in all aspects of his professional and personal life. This immigrant teacher had migrated from Myanmar, and from his written responses (such as those shown below), it appeared that a cause for this kind of professional change was perhaps the deeply-ingrained negative experiences brought about by strong political or institutional agents in a teacher's home country. A contrasting view of the Australian society as being *fair* and *free* might, then, induce the immigrant teacher to embrace all that the host society has to offer.

Excerpts of this immigrant teacher's responses will be presented below for the purpose of sharing with readers the affective intensity he had been (and still was at the time of this study, apparently) going through whenever he was reminded of Myanmar. This serves to help us understand why the teacher embraced all that were associated with the Australian mathematics education system. This also potentially enables us to understand why intense affective experiences can stimulate significant value changes over a short period of time, at the same time providing support for the argument against the 7 criteria of the 'valuing process' (see Section 2.2.2).

Australia embraces TRUE democracy. In Burma [as Myanmar was previously called], tyrants still reign. Power is expressed as [the] number of fire-arms one owns. You would be king, if you own a nuclear missile in BURMA. (RMQ 42b)

Burma was always, will always be ruled by despots. For many years, they wrongly used the word 'democracy' (1948-1962). But not a singular Burman ever understood the meaning of 'FREEDOM'. Canes, chains, goals, missiles are their built-in culture. (RMQ 43b)

I am an Australian now, I love democracy practised in this great Nation [sic]. I am not influenced by Burmese Culture in any way in my teaching at all. (RMQ 42c)

I have come to Australia to enjoy a perfect life-style. I am not [in] the least bent by Multiculturalistic approaches. My philosophy is that, I will do what the others do except going out sun-bathing because my skin is dark enough. (RMQ 42d)

[With regards to school mathematics,] the significance difference between two means μ_{Burma} and $\mu_{Australia}$ is none, in the way that, both samples originate from the same culture, predominantly English. But the way it is taught is culturally different. One is taught with a cane, the other is by means of positive appraisal. (RMQ 43a)

This difference has influenced in [sic] my teaching, giving a free-people to learn something of value in their own will. As a matter of fact, you should learn how we teach our kids in Australia instead of creating a cultural diversity. (RMQ 43c)

6.2.1.4 The Amalgamation Approach

When a perceived value difference is negotiated with the amalgamation approach, the immigrant teacher's subsequent practice portrays both the home and host cultures' pedagogical traditions, such that the values involved coexist and that the cultural traditions which these reflect are identifiable. In this manner, the amalgamation approach differs significantly from the three approaches discussed earlier. The status quo, assimilation and accommodation approaches represent a teacher's alignment with values related to either her home culture or the Australian culture that are involved in the perceived value differences. When the approach adopted is one of amalgamation, however, the teacher is mediating the situation by portraying relevant values of *both* the home and Australian cultures. That is, as far as the classroom interaction encompassed by the perceived value difference is concerned, the teacher is neither practising as she would have been had she been teaching in her home culture, nor acting in ways that correspond to a 'typical' Australian secondary mathematics teacher.

Three of the teacher participants had adopted this responsive approach in 3 different perceived value difference situations. Khaliq's practice in Lebanon and Victoria had led him to value both *application* and *concepts* in his pedagogy. While Betty continued to identify with algebraic solutions to mathematical problems, the competing value of *efficiency* had resulted in Betty valuing student use of *technology* to solve more tedious problems. For these two teacher participants, it is likely that the level of internalisation of *application* (for Khaliq) and of *technology* (for Betty) had increased within their respective personal value schemas after they had begun teaching in Australia. If the values of such systems are seen to be related in a schema-like fashion, then the effect of an immigrant teacher adopting the amalgamation approach on the personal value schema may be visualised as a relocation of value branches (corresponding to the new adopted values) closer to some central core. In the cases of these values being embraced for the first time, the corresponding effect would then be one of the introduction of new branches. This visualisation of the organisation of the personal value system as schema is also useful in discussing competing and overriding values, and it will be highlighted again in Section 7.1 of the next chapter.

Regarding his perception of a cultural difference in the valuing of *technology*, Saka drew on his personal valuing of *efficiency*. While institutional policies had meant that

Saka had to allow his students to continue using the calculator in his mathematics class, he had to allow student access to *technology*. On the other hand, his valuing of *paper-and-pencil skills* and *efficiency* was manifested at the same time, through his explicit encouragement to students to make use of these personal computation skills to work more efficiently. Thus, both *technology* and *paper-and-pencil skills* were amalgamated in Saka's actions and emphasised simultaneously, while features of these individual values remained distinct and 'separable'.

It is also interesting to note that in the value difference of *technology* perceived by Betty and Saka, where *efficiency* expressed itself as a competing value, the nature of its influence was in opposite directions. In Betty's case, her valuing of *efficiency* was prompting her to embrace the emphasis on *technology*. On the other hand, for Saka, he had associated non-technological ways of doing mathematics as being more efficient for the solution process. Thus, this culturally-referenced valuing of *efficiency* provided a striking example of the socio-cultural nature of perceived value differences. In other words, the same value (such as *efficiency*) embraced by two different cultures may be interpreted and espoused in ways which lead to opposing actions, creating dissonance and even conflicts!

6.2.1.5 The Appropriation Approach

The appropriation of perceived value differences was the most commonly adopted approach amongst the immigrant teachers, accounting for 12 of the value difference situations observed. All but one of the eight teacher participants were found to have responded to at least one perceived value difference through appropriation. When a teacher appropriates difference, aspects of her teaching style that are related to the value difference undergo a transformation that customises them to the Victorian school mathematics pedagogical context, by blending appropriate and relevant values of both the home culture and the Australian culture. Whilst features of the home and/or Australian culture may be identified individually in the amalgamation approach, with the appropriation approach these may not be easily picked up as distinct qualities.

For example, in one of the value differences perceived by Deanne, her valuing of *precision* in the use of mathematical language was challenged by the need to take into account the emphases on (student) *confidence, concept* and *skill* in her Victorian mathematics classroom. While she remained committed to the need for students to

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cultivate the value of *precision*, she did not negotiate the value difference with the status quo approach. Neither was her response (discussed in Section 5.4.2.1) demonstrative of amalgamation, as there were instances in which Deanne had downplayed the emphasis of *precision* (see Section 5.4.2.1 for examples). To the extent that fostering student confidence was an important consideration in Victoria, to the extent that cultivating student competency of the related concepts and skills was crucial, Deanne was ready to allow her valuing of *precision* to be portrayed less correspondingly. Adopting the appropriation approach to resolve her dissonance, Deanne's practice took on a form which incorporated both sets of values in a way such that their espousal represented a balance in emphasis between themselves according to the context in which the value difference occurred.

Another example of appropriation was demonstrated through Manoj's negotiation of differential valuing of *academic achievement*. Over the years of teaching in Victoria, he had come to value what might be called *capability*, embracing the idea that students could differ from one another in terms of cognitive capabilities. While Manoj continued to value *academic achievement*, the appropriation approach to mediating its 'clash' with *capability* had meant that he could not possibly expect all students to excel in school mathematics. Thus, again, there was a situation where the ongoing emphases of both these values could not be made at levels corresponding to Manoj's internalisation of each of the values individually, but rather, they co-existed by balancing each other's portrayal.

The idea of the value schema was mentioned in the discussion of the amalgamation approach (Section 6.2.1.4). While the value schema of an individual involves either the addition of new 'value branches' or the promotion of some existing ones, our discussion of appropriation implies that the value schema is probably more structurally affected in ways which alter not just the location of 'value branches', but the nature of each of these as well. Deanne's appropriating of the value difference of *precision*, for example, might have prompted a reorganisation of her value schema, specifically 'value branches' relating to *precision*, *confidence*, *concept* and *skill*, one which not only affected the relative position of each of these to the central core, but also (as we have seen) the meaning attached to each value, including how each has become related to the valuing of the others.

6.2.1.6 Teacher Affinity with Australian Values

Betty's response to her perception of the value differences of *application* and *administrative support* has been described in this study as one of affinity. While Betty believed that the Victorian and English educational systems valued the applicational nature of (school) mathematics and the nature of administrative support available to teachers in different ways, she had questioned the way in which these two aspects of her practice was actualised in England. There (in England), Betty had developed a valuing of explicating the applicability of mathematics, and a frustration at the lack of opportunities for teachers to expand or enrich their professional worldview. The professional workplace in which Betty found herself after migrating to Victoria, on the other hand, appeared to her to be embracing *application* and *administrative support* in ways which were aligned to her valuing of these qualities. Thus, although a value difference was perceived in these two instances, they were not likely to be sources of dissonance for Betty; instead, she felt a personal affinity to these aspects of mathematics pedagogy and institutional organisation.

Betty's data indicated that while the personal value systems of most immigrant teachers might be aligned to the values of their home cultures, ongoing experiences or developments within these home cultures could also have prompted their members to question some of the values the cultures purportedly upheld. That two of the three types of value differences perceived by Betty were instances of affinity did not imply that her personal values were not typically English, however. This is because there might well be values to which Betty subscribed which were equally embraced in the Victorian and English educational cultures, and which thus did not express themselves in the form of value differences.

The sense of frustration and helplessness reported by Carla (Section 5.3.2.5) in some cases of her perceived value difference relating to *power distance* indicated the possibility that not all of these value differences were, or could be, mediated successfully by the immigrant teachers. This phenomenon was also noted in one British immigrant teacher responding to the questionnaire survey (Section 4.2.2), where he expressed his frustration at aspects of the mathematics educational culture in Victoria with which he was unable to effect desired changes. These examples serve to remind us that despite immigrant teachers' successes at negotiating perceived value differences, and despite their remaining

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in the mathematics teaching profession, these need not indicate in any way that all of them had been able to resolve the differences they had perceived as they practised across cultures. Also, the responsive approaches an immigrant teacher has adopted in mediating some value differences need not be equally effective in helping her deal with the other differences she might perceive, and this is perhaps one of the main reasons why the teacher participants in this study had been observed to select multiple responsive approaches.

In fact, Carla's experience with the differential valuing of *power distance* in the Victorian and Romanian mathematics classrooms presents an example in which any one value difference might be negotiated successfully in relation to some context (e.g. when Carla felt that the student comments were made in response to some mistake she had made), but remained unresolved given a different set of contextual conditions. There is no reason to propose that Carla's apparent inconsistency in negotiating differences in the way *power distance* was valued was an unique set of incidents; different contexts within which value differences occur do logically affect personal meaning-making of the associated reality, thus calling for the interpretation of each of these using different personal values. That Carla felt a sense of personal responsibility as contributing to the student behaviour in some of the *power distance* incidents had obviously guided her interpretation of what the students said as being somewhat justifiable. In situations where she felt that she was not personally at fault, the same kind of student behaviour would have been a source of frustration for her.

In other words, although the immigrant teachers participating in this study had been able to mediate all but one of the 34 incidences of reported value differences, there exists a likelihood that future perception of any of these in a different set of contextual conditions may turn out to be a continuing source of dissonance, frustration or helplessness for any of the immigrant teachers.

6.2.2 Beyond Responsive Approaches

While the conceptualised range of teacher responsive approaches (shown in Table 2.3) has been useful in contextualising and making sense of the experiences of the immigrant teachers in this study, the exercise also highlighted the possibilities that a teacher's personal values might actually be aligned with Australian values (instead of her home culture's values) in some perceived value differences, and that not all value

differences that were perceived were responded to in ways which eliminated dissonance. The five approaches listed in Table 2.3, nevertheless, have been found in this study to be useful when exploring value differences. Furthermore, Betty's affinity with two Australian values was contextualised against her knowledge that there was no need for mediation. Also, Carla's sense of helplessness with the perceived difference in the valuing of *power distance* reflected the difficulty she sometimes faced in resolving the dissonance that she perceived.

An inclusive presentation of the immigrant teachers' *responses* to perceived value differences would thus be more than accounting for the *approaches* that may be adopted to negotiate these differences. It would not only celebrate the teachers' abilities in responding successfully to difference, but would also highlight obstacles and difficulties experienced by this group of teachers in other instances of perceived value differences. Such a presentation would also demonstrate that not all perceived value differences are necessarily signposts to dissonance and conflicts. An attempt at this kind of representation is shown in Table 6.1. Understandably, some of the descriptions of the responsive approaches have been fine-tuned, as a result of the meanings constructed through researching with the immigrant teachers in this study.

The possible teacher responses listed in Table 6.1 should not be regarded as a taxonomy. In other words, professional socialisation is not associated with a developmental progression of responses to perceived value differences, from helplessness to appropriation (or in some other order). There has been no indication in the data collected that responsive approaches change with teacher experience, or that some approaches were more empowering than others in helping immigrant teachers mediate the value differences. With the obvious exception of helplessness, each of the other responsive approaches appeared to enable the immigrant teachers concerned to restore consonance and resolve conflict in their own unique ways.

That is not to say, of course, that the responsive approach to any particular value difference does not possibly change through time. Personal values change (Section 2.2.4) as a result of ongoing experience and reflection, and the transition process immigrant teachers go through in the workplace and in the wider Australian society can intensify such an evolution. As a result of such modification of personal values, sensitivities to and reflections of what might constitute Australian and home culture's values develop, and

interpretation and sense-making of difference and conflict are fine-tuned. Against this background, it is reasonable to propose that experience and length of service can stimulate changes to responsive approaches. A longitudinal research design applied to a similar study such as this should be able to uncover such developments. What is not likely is that these changes reflect the adoption of 'better' ways of mediating value differences — at the time of negotiation and mediation, the approach adopted is contextually the best response since it serves to restore the individual's sense of consonance.

Table 6.1

Responses by Immigrant Teachers to Perceived Value Differences in Mathematics Education

Culture to which personal value is aligned	Response	Assumption	Teaching
Australian culture	Affinity	There is no culture conflict; my value is aligned with the Australian culture.	The Australian culture supports my mathematics teaching style.
Home culture	Helplessness	There is no apparent way to negotiate the different values satisfactorily.	My mathematics teaching style may not be consistent, and I may not know what to do.
	Status quo	My home culture should be espoused.	I teach mathematics in the same way I did in my home culture.
	Assimilation	The Australian culture should influence the surface characteristics of my mathematics teaching.	I include the Australian cultural contexts in my teaching, such as in examples and problem sums.
	Accommodation	The Australian culture should be espoused.	Planning and classroom decisions portray the Australian culture.
	Amalgamation	The essence of my home culture and the Australian culture should guide mathematics teaching.	My teaching reflects a synthesis of teaching styles from my home culture and from Australia.
	Appropriation	My home culture and the Australian culture should interact to inform my mathematics teaching.	My mathematics teaching style consistently reflects an adaptation of my home culture to local norms and practices.

Thus, as we saw in Chapter 5, Saka might have only taught for 1 year in Victoria, but his responsive approaches to perceived value differences incorporated the relatively more cognitively complex approaches of amalgamation and appropriation. On the other hand, Manoj had clocked 27 years of mathematics teaching in Victoria, but his choice of the

status quo approach in his practice did not appear to have undermined his professional effectiveness, nor his affective health.

It might be obvious that the nature of an immigrant teacher's personal value system affects her interpretation of any mathematics classroom incident as a value difference (or not), at the same time as it defines the extent to which the home culture's influence contributes towards a gap between personal values and Australian values. In terms of the responses to such differences, however, what emerged from the data was a sense amongst the immigrant teachers that social factors played a significant role in helping them interpret, and subsequently respond to, difference. As is evident from the various value difference matrices, these factors might be contextualised in different aspects of the immigrant teachers' professional reality (classroom, institutional, cultural, etc.), and might act as either constraints or affordances towards any inclination to act in ways that embrace the home cultural values. This will be the focus of the next section.

6.3 Contextual Factors guiding Teacher Responses

6.3.1 Factors Contributing to Perceived Value Differences

Data from both the questionnaire survey (in particular, to item numbers 40 — 44) and the in-depth study with 8 immigrant teachers have suggested that immigrant teachers' (subconscious) choice of responsive approaches to perceived value differences were guided by social factors that related to the value differences as these were perceived. Although it was not the focus of this study to account for the causal factors of the value differences perceived, it was inevitable that the teacher discourse was often contextualised against the sources of the differences. As we saw in Section 4.2.3, the questionnaire survey responses demonstrated immigrant teacher attribution of the perceived value differences to historical, political, societal and economic factors. Similar messages were also heard during the interviewing of the eight teacher participants, as reported in Chapter 5. For example, Deanne's perception that *diversity* was not as valued in her mathematics classroom in Victoria as in Canada was contextualised in her observation that aspects of the Australian society were found wanting in embracing this value, such as the community within which her school was situated and the textbook writers. The following quote relates to how these societal factors might influence the

attitude of students in Victoria towards valuing *diversity*:

> you might be having a conversation with kids particularly given what happens [sic] in the States [ie the September 11 tragedy at New York], and with the refugee crisis [ie the plight of asylum seekers at detention centres in various parts of Australia]. Some of the attitudes are quite shocking at times, part of that is because they are kids, and part of that is maybe they are attitudes they get from older parents. But they are not quite as embracing difference as I like them to be. (DP3: 43-47)

Quite clearly, these historical, political, societal and economic factors that contributed to cross-cultural value differences could be related to the values embraced by the local culture. The discussion in Section 2.2.1 highlighted the significance of values as cultural products of shared meaning. Such values might exist at the interactional, institutional or societal level. Thus, Rana's observation of a differential valuing of *groupwork* between Victoria and India was interpreted by her to be a reflection of how the value was embraced at the institutional level:

> Here [in the Australian classroom], it's — we don't really care that you work with someone else to get your solution, provided you understand it. That's the attitude here. Over there, it has to be yours, because you are going to be assessed on it. It must be some overt kind of answers. And you can't get help for — you must do it by yourself. That's a big difference. So group work is encouraged here. Group work is not encouraged there. (RP2: 106-110)

Factors contributing to perceived value differences have been discussed here in a section devoted to factors upon which immigrant teachers' responsive approaches were based, because these sources of difference were often part of the contextual factors guiding teacher response. For example, in Deanne's case, a consideration of both the little cultural variation in the community and teachers' frequent dependence on textbooks probably constituted part of Deanne's reasoning over the most appropriate response to the value difference regarding *diversity*.

6.3.2 Values Underlying Contextual Factors

These contextual factors were themes identified by the immigrant teacher participants and me during our inquiry into the ways in which perceived value differences were negotiated by them. These themes might be the immigrant teachers' conceptions and interpretations of the value difference, such as Saka's belief in the importance of regular exercising of the brain to maintain students' proficiency in mental computation in the value difference relating to *technology*. They might also be externally-referenced; for example, in Saka's perception of a difference in the valuing of *technology*, one such factor was his observation of students' reliance on the calculator in Victoria. Such a factor might also be viewed against a wider context beyond the classroom, such as Khaliq's

awareness of career trends in the Australian society in his negotiation of the value difference of *customisation*.

Each of these contextual factors could be seen as a manifestation of personal or societal values. Whether the factors arose from an observation of a phenomenon, from an interpretation of a phenomenon, or contextualised within the personal belief of the 'players' in the value difference situations, they reflected the worldviews and emphases of the immigrant teachers' respective home cultures and/or Australian values. That Carla responded differently to the value difference of *power distance* in different contexts reflects how a different configuration of the set of contextual factors might affect the responsive approach adopted in any value difference situation. For Carla, the presence or absence of the contextual factor of her making a mistake in class was evidently pivotal in guiding her subsequent response to comments made by her students. Carla's concern against denting student confidence was also a factor that influenced her response:

Interviewer:	.... What happened was that you told them to write at the top of the _ worksheet, 'calculators, etc, degrees', okay. And you have this, and you said that, "we normally make mistakes, and we forget to change from radians to degrees." And you have that girl _ behind who shouted out this thing, "including you?"
Carla:	Yeah.
Interviewer:	I assume that we don't get this type of response from students in Romania?
Carla:	No, no.
Interviewer:	So, what went through your mind before you responded to her?
Carla:	Now I'm used to this, and I'm used to _ see, this is the difference here: there are so many students who are, lack self-confidence, right?
	So I have taught myself to tell the kids that I make mistakes too.
	In Romania, the teacher is perfect, the teacher never makes mistakes, right?
	While here, you see, this is one of the ways that I have adapted to the conditions. Here you have to tell the kids that anyone can make mistakes, so, yes, even I can make mistakes. Because _ their self-esteem is so low; there's nothing like that over there, so, you know, you have to go to the kids actually, you know. And, yes, I mean, some are perfect, but no one is perfect. And yes, I make mistakes, so I'm used to that now.

(CP1: 249-272)

The intimate relationship between values and action was discussed in Section 2.2.3. In particular, it was highlighted that while values need not always be enacted, they clearly played a key role in guiding an individual's decision-making process leading to a choice of action. This study has provided examples of a range of contextual factors which have

been expressed in terms of their underlying values, and it had been significant to examine how the values underlying these contextual factors 'compete' for articulation through the teachers' responsive approaches.

6.3.3 Facilitating and Constraining Contextual Factors

The representation in the value difference matrices of the contextual factors (see, for example, Table 5.3) highlighted one way of classifying these factors, into facilitating (in the sense that they supported the portrayal of values associated with the home culture) and constraining (factors which constrained the portray ʒ ᵒf home culture's values). As shown in the note section accompanying each value difference matrix, the facilitating factors were aligned with the home culture's values and were denoted by the plus sign, whereas the constraining factors were denoted by the minus sign.

An exploratory survey of the questionnaire had revealed a possible association between facilitating contextual factors and value differences related to school mathematics, and an association between constraining factors and value differences relating to mathematics pedagogy and mathematics discipline (Section 4.2.3). This pattern, or any pattern for that matter, could not be discerned from the data collected in the in-depth study with 8 immigrant teacher participants, however. Moreover, relating nature of perceived value differences to nature of contextual factors may not be very useful practically (given the depth of data collected with the 8 teacher participants): the nature of value differences (i.e. mathematical, mathematics educational, general educational, organisational) is beyond an individual's control, and thus it may not be a helpful approach from the perspective of professional development concerns.

On the other hand, given the breadth and depth of data collected in the in-depth phase of this research, it may be worthwhile to look for any relationship between responsive approach and nature of contextual factors (i.e. facilitating or constraining). If any pattern can be discerned between these two variables, then, opportunities exist for modifying the context within which perceived value differences occur to increase the chance of particular responsive approaches to be adopted. An examination across the eight value difference matrices, however, did not provide evidence of any relationship between an immigrant teacher's responsive approach on the one hand, and the proportion of facilitating (or constraining) factors on the other, for any given value difference. Thus, the status quo approach, say, may be associated with the negotiation of perceived value

differences that had been contextualised in a set of facilitating factors. Yet, even though Rana's response to the value difference of *process* was one which was status quo (Section 5.6.2.1), the negotiation process had likely taken into account two constraining factors too, namely, that of 'cultural freeze' and of the pressure of time brought on by her teaching schedule.

Likewise, neither the assimilation nor the accommodation approaches was associated with sets of contextual factors which were all aligned with the Australian values. Li Kang's assimilation of the valuing of *technology*, for example, was a responsive approach that was adopted despite the presence of a facilitating factor, that is, his personal belief that student mastery of skills related to particular mathematical topics should precede the introduction of technology. When Carla accommodated to what she considered as rude comments made by students, a personal contextual factor related to respect for authority was a facilitating factor operating against constraining ones. It appears that in these situations, values related to admission of mistakes and maintaining student confidence were more important to Carla than *respect* (for authority).

Since the amalgamation and appropriation approaches incorporate one or more of an immigrant teacher's home culture values, as well as of the Australian values, it may be expected that the contextual factors which related to each of the value differences concerned included both facilitating and constraining factors. Indeed, the data showed that each amalgamation or appropriation took place in the context of both these types of factors, amongst which were values from both Victoria and the home cultures that were affirmed together by the immigrant teachers through their chosen approaches.

The affinity responsive approach had not been associated with any contextual factor, because the adoption of the approach in each of the cases observed in this study appeared to be a direct response to a perceived favourable situation whereby there was an alignment between what was valued personally by the immigrant teacher and what was seen to be valued in the Victorian mathematics classroom. There was no evidence that the contextual factors had influenced any immigrant teacher to continue to embrace her own values through the affinity approach.

The discussion above highlights the possibility that beyond the number of and nature of contextual factors operating in each of the value differences, the nature of the underlying values of these factors were playing a pivotal role in guiding the immigrant

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teacher towards the most appropriate responsive approach for the particular value difference situation. Thus, the influence on the immigrant teacher of, say, 3 facilitating factors needed not be similar to 3 constraining factors. As has been alluded to earlier, these values were more likely to relate to — and influence — one another as competing or overriding values. Examples of how these values probably functioned as they were observed in the data of this study will be discussed in the next section.

6.3.4 Competing and Overriding Values

In a general sense, the notion of immigrant teachers of mathematics adopting responsive approaches to perceived value differences in the context of epistemological, pedagogical and societal factors (some facilitating, others constraining) by itself can be considered to be a meeting of competing values in each of these negotiation processes. As contextual factors were compared with and weighed against one another (albeit subconsciously at times), the values underlying these factors might be imagined to be competing with one another for affirmation and subsequent portrayal. At times, one such value would stand out from the rest, such as when the status quo, assimilation, accommodation or affinity approaches were adopted by the immigrant teacher. At other times, two or more values were embraced together (in the case of the amalgamation approach), or were interacting to help define a novel, customised pedagogical practice (in the case of the appropriation approach).

The discussion of competing (and overriding) values may also be made more focussed, by looking at the teacher negotiation process as possibly involving competing values that were all part of an immigrant teacher's personal value system. In such a situation, the perceived value difference might be contextualised against a set of factors, some of which were associated with values which the immigrant teacher also embraced. The negotiation process, with the subsequent adoption of a responsive approach to mediate the value difference, became one of challenging the composition of the personal value system.

A few examples from the data may help to illustrate these relationships. In Carla's perception of the value difference of *power distance*, her personal valuing of this nature of teacher-student relationship was challenged by contextual factors which were associated with competing values such as (student) *confidence* and *self-esteem* (Section 5.3.2.5). Though these competing values might have constituted part of Carla's set of

personal values, they might not likely have been related to her valuing of *power distance*, if not for the constraining factors that operated in that value difference. Whatever responsive approach Carla chose to negotiate the value difference of *power distance* with might have tipped the balance of emphasis amongst the competing values, although this relative emphasis of one competing value over the rest was likely to remain sensitive to prevailing contextual factors. Thus, in cases when Carla felt that the value difference had been initiated by some mistake she had made in her practice, her accommodation approach affirmed the relative dominance of *confidence* and *self-esteem* over *power distance*. In other occasions, *power distance* appeared to assume a greater emphasis compared to the other two competing values, to the extent that it rendered Carla helpless in her response to students' rude remarks.

Teacher negotiation of value differences involving personal competing values were also documented with other immigrant teachers. We saw in Section 5.7.2 how Betty's valuing of mental or paper-and-pencil ways of doing mathematics (against the greater valuing of *technology* in Victoria) was challenged by her personal valuing also of *efficiency*. For her, the quickest method of solving any mathematical problem was valued, and she recognised that both the competing values could possibly be emphasised at the same time. By amalgamating *efficiency* and *technology*, Betty acknowledged that there were situations when valuing *technology* in her practice supported her valuing of *efficiency*, situations where the use of the calculator led to a quicker solution process compared to mental or paper-based methods.

Li Kang's mediation of his experiencing of dissonance with regards to the valuing of *technology* in Victorian classrooms also involved personal competing values (Section 5.9.2). His concern at what he observed to be student reliance on tools like calculators was similar to Betty's. The competing value associated to this value difference of Li Kang, however, was different from that of Betty's; his valuing of (student) *self-esteem* presented for him a tussle between discouraging students from relying too much on technological tools in their mathematical work and sustaining students' sense of worth through use of these tools. (As will be discussed in the next section, *self-esteem* was possibly a second-hand value when it was first embraced by Li Kang.) Ultimately, Li Kang's response was one of assimilating the value of *technology* in his practice. Clearly, *self-esteem* 'got the upper hand' in this particular value difference, though Li Kang's action might give others the impression that *technology* was embraced too, when in fact

he remained as concerned as ever of student use (and misuse) of technological tools like calculators in their mathematics learning.

These three immigrant teachers' experiences involving personally-held values in competition with one another have demonstrated how difficult it can be to try to predict the outcomes that resulted. Indeed, as mentioned earlier, the different responses that Carla displayed in her negotiation of differential valuing of *power distance* indicated just how sensitive the relationship between competing values could be to changes in contextual factors.

Our discussion in Section 2.2.3 has also referred to overriding values as a group of highly prioritised values within an individual. In this study, *concepts / skills* and *confidence* appeared to be the more internalised and prioritised — that is, overriding — values in Deanne's socialisation process in the Victorian mathematics classroom. The extent to which Deanne valued student *confidence* and mathematical *skills* was evident in the discussion of her personal values and beliefs (Section 5.4.1.3). In fact, when asked what advice she would give to newly-arrived immigrant teachers, Deanne identified the fostering of student *confidence*:

> I'd advise them to really emphasise what the kids can do, so whether — choose practice things that they can do, and intermingle with the things that are a bit more difficult, so really build on their confidence levels, particularly before a big exams, because confidence is the biggest thing that they feel, if they can do it, and then they won't get thrown when they are in there. (DP3: 245-249)

To her, a measure of her sense of satisfaction about a lesson was concerned with the extent to which she could increase student confidence in doing mathematics (DP3: 233-239). As for *concepts*, the centrality of this value in Deanne's value system could be discerned from the priority she accorded to it in her content delivery, such as in the first time she was teaching a mathematical topic (DP1: 92-96), ahead of her emphasis on *terminology* and *precision*.

Thus, although Deanne appeared to place a lot of emphasis on *precision* as a characteristic of mathematical knowledge, evidence (such as discussed in Section 5.4.2.1) suggested that it was overriden by a greater priority placed on *confidence* and *concepts / skills*. The apparent inconsistency in Deanne's grading of student written work was also interpreted in that Section as a demonstration of the overriding values of *confidence* and *concepts / skills* in operation. It was also interesting to note that in some instances even the encouragement to students to use formal mathematical language could serve the im

of promoting their confidence in the subject as well. That is, paradoxically perhaps, the overriding nature of *confidence* over *precision* could take the form of *precision* being portrayed as a means to facilitate *confidence*. For example, Deanne explained how this might relate to student articulation of mathematical speech:

> I think it's another thing that helps those weak kids, if they are using the language of mathematicians, and sounding like mathematicians, then they get a sense of doing it, being part of that mathematicians' community. For some of them, maybe the language part is the [only] part that they grasp, because they might be strong linguistically. So if they're getting the right terms and using the right words, they are part of that community .... That will raise their confidence levels. (DP2: 238-247)

In the above example with Deanne, the role of *confidence* as an overriding value over *precision* was not expected to translate into a dominance over other competing values, although the extent to which it was internalised could well lead to such a possibility. A value which overrides another in terms of personal priority in one value difference situation might be confronted with another equally internalised, thus competing, value in another situation.

6.3.5 Second-hand Values

The concept of second-hand values was introduced in Section 2.2.3. In the context of this study, these values may be regarded as values which were observed by the immigrant teachers to be embraced by colleagues and other people successfully in the Victorian educational system, and which were not part of the immigrant teachers' own personal value systems. It is likely that most of the time these values were also aligned with the Australian (mathematics educational) culture, though they need not be; a particular value observed by an immigrant teacher to have been portrayed by a colleague or expert might be brought on board by the immigrant teacher as a response to a perceived value difference in a critical incident, simply by virtue of the fact that the value appeared to fit the local educational scene well. Whether it was an Australian value or not might not have been a consideration at all.

In this study, a teacher's action was considered to reflect a second-hand value if she referred it to a similar action made by a peer or by another person in the Australian culture, or if the contextual factors indicated a course of action that was made purely on observed practice in the Australian culture. The reflexive nature of adopting second-hand values would mean that teacher responses portraying such values were often made before due consideration to the merits of portraying the associated values. Thus,

epistemologically- and pedagogically-based choice of course of action will not likely be a feature of responses reflecting second-hand values.

Adopting this perspective, it appeared that teacher responsive actions that were informed by second-hand values were only found in one instance in this study. This related to Li Kang's perception of the value difference of *self-esteem*. Teaching in Victoria, he had become aware of a greater student sensitivity to the state of their own self-esteem. Though his memory of how Malaysian students would react to teacher criticism and comments might have prompted the perception of a difference in the students' valuing of *self-esteem*, Li Kang's awareness of 'cultural freeze', as well as his expressed desire for his professional practice to reflect Australian cultural values, were factors that could have led Li Kang to simply 'do as the Romans do'. That is, he would act in ways which protected students' emotional sense of self by, for example, posing classroom questions to the class rather than to individual students (LP1: 194).

In fact, it may be argued that Li Kang's belief that the mathematical, mathematics educational and other educational values he portrayed should align themselves with Australian cultural values had put him in a position that predisposed him to take on second-hand values that were prevalent in his workplace. Li Kang had explicitly clarified this belief in several occasions during his participation in this study. In his questionnaire response, he had also identified the following as being the most influential factors guiding his responses to perceived value differences: Australian cultural values, colleagues' tried and proven strategies, as well as the school ethos and institutional culture. Furthermore, the next significant influencing factor was the school community and parents' concerns (LQ41).

The discussion in Section 2.2.3 had flagged the possibility of a second-hand value being internalised by the individual portraying it. Data collected from Li Kang appeared to support this scenario. He had even accommodated to the valuing of *self-esteem* (Section 5.9.2). Specifically, there was the possibility that this second-hand value was internalised within Li Kang enough to contribute to his assimilation of *technology* in his practice (Section 5.9.2).

6.3.6 A Look at Manoj's Contextual Factors

During the analysis of data (collected from the eight immigrant teachers) relating to contextual factors guiding teacher responses to perceived value differences, it was noticed that Manoj's case stood out from the rest. Whereas the factors identified by the other immigrant teachers could be positioned within different socio-cultural contexts (e.g. personal, classroom, institutional, societal, national), Manoj's appeared to be predominantly related to his professional beliefs. As has been visually summarised in his value difference matrix (Table 5.6), and elaborated in Section 5.5, Manoj's considerations of perceived value differences appeared to be in the form of internal debates amongst associated beliefs, which might manifest as facilitating or constraining factors. Although personal beliefs also constituted contextual factors experienced by the other immigrant teachers (e.g. Deanne's belief that not all students were able to demonstrate their capabilities fully through tests in her value difference of *alternative assessment*), they were not as overwhelming in number (e.g. using the same example from Deanne's experience, there was also the contextual factors of an awareness of 'culture freeze' and of opportunities within the school curriculum for alternative assessment to be implemented). It was as if Manoj's assessment of the value differences he perceived was conducted from a more removed stance, one in which he could maintain emotional distance and exercise rational reasoning over the contextual factors available.

Thus, in negotiating the value difference of *relevance* (Section 5.5.2.1) for example, Manoj was found considering the relevance and importance of factors reflecting two of his beliefs, namely, that the purpose of learning was to prepare oneself to lead a satisfactory life, and that an appreciation of *relevance* by students might motivate them to practise basic skills. Also, in responding to the value difference of *academic achievement* (Section 5.5.2.5), the contextual factors included Manoj's beliefs that different people possess different potential, that academic attainment was not the sole determinant of a person's success in education, and that a student should utilise her ability to her best, although in this case Manoj's interpretation of a low Australian valuing on school mathematics *achievement* constituted a contextual factor that was more societal than personal.

This phenomenon could of course be attributed to Manoj's uniqueness as an individual, although there was also the possibility that this might be due to Manoj's

exceptionally rich experience in teaching (31 years in all, 27 of which were in Victoria), relative to all other seven immigrant teachers. It was noted earlier that despite his years of teaching in Victoria being the longest amongst these immigrant teachers, value differences continued to be perceived by Manoj. It was also observed that compared to the other teacher participants in this study, the difference arising from his years of service in Victoria might lie in the greater ease with which he responded to these perceived differences. Might this have been so due to a rich socialisation experience validating a set of beliefs for Manoj, with which he could use to make sense of value differences perceived in the course of his practice in Victoria? This perspective acknowledges Hofstede's (1997) 'acculturation curve' (see Section 2.3); in particular, the possibility that Manoj's experience had acquired for him a 'stable state' of mind represented by Phase 4 in the curve. In this phase, Manoj was likely to remain aware of what happened in his workplace context whenever value difference was perceived; the stability of mind, however, probably meant that instead of weighing these out affectively and rationalising amongst these, Manoj had been able to interpret what he observed and what he perceived in terms of the underlying beliefs, both facilitating and constraining. In this manner, the negotiation process was conducted at a more remote and less emotional level, since Manoj was then making sense of his professional reality by examining beliefs rather than considering his experiences of lived events.

As was argued in Section 2.3.1, this study was designed to inquire into the professional socialisation of immigrant teachers through investigating the interactive level (Pollard, 1982) of workplace-based influences. Examples of such influencing factors were documented in this study, such as the role played by students' positive response to Carla's practice, and Betty's observation that students had been making inappropriate use of technological tools in the course of their mathematics learning. Not surprisingly, the nature of this study has also contextualised teacher socialisation in the other two levels as well, that is, institutional and cultural. The constraining factor posed by Rana's teaching schedule is an example of an influencing factor existing at the institutional level. On the other hand, there were also influencing factors at the cultural level, such as Saka's observation that the Australian society placed relatively little emphasis on student achievement in school mathematics. Having conducted this study from the values perspective, these different levels of contextual factors could all be related to the individual. With the discussion of the role of values establishing a framework (in Section

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2.2) for understanding and interpreting, contextual factors guiding immigrant teachers' negotiation of personal value differences were seen to provide the impetus for values underlying such factors to be negotiated against one another. The agency of the individual in responding to value difference, and thus its role in facilitating professional socialisation, was explicated through the interaction of values within the individual's personal value system.

Although the focus of this chapter has been to discuss the data collected from immigrant teachers of secondary mathematics practising in Victoria, particularly the eight teacher participants with whom extensive research work was carried out, this discussion has also begun to inform possible responses to the three research questions as it developed. In particular, this discussion highlights once again the complexity that is potentially involved in inquiring about professional socialisation across cultures, and researching with a values perspective.

The interpretation of the data collected has been made with reference to the theoretical framework informed by contemporary academic knowledge of the socio-cultural context of mathematics and mathematics education, of values related to mathematics and mathematics education, and of teacher socialisation. At the same time, this interpretation has also fostered opportunities for theory-building. This will be the intention of the content within the next chapter.

CHAPTER 7

THEORETICAL REFLECTIONS

In the last chapter, the results of the study were discussed. Multiple data sources had been used to collect the relevant data. In facilitating the discussion, responses to the three research questions guiding this study were offered. In the discussion, it became evident that the existing understanding of related theories and knowledge mentioned in Chapter 2 may be developed further in the light of the data obtained.

The following sections in this chapter will attempt to further our understanding of some of these theoretical ideas. As the construct of personal, culturally-based values was found in the last two chapters to be helpful in providing a way of interpreting and making sense of negotiating each value difference perceived by the immigrant teachers, theory-building in this chapter will begin with an examination of the personal value system. Specifically, the possibility of regarding a set of personal values as schema will be explored. In the next section, the notion of choice in the valuing process will be challenged again in the light of this study's data. The dynamic nature of the process will also be emphasised. Shifting the focus from value schemas to how these might influence teacher choice of responsive approaches, the discussion will move on to relating the amalgamation and appropriation approaches to the notion of complementarity (Bishop, 1988). In mediating the perceived value differences, a sense of cultural relativism appeared to have been empowering for at least one of the immigrant teachers. This will also be discussed towards the end of this chapter.

7.1 The Personal Value Schema

Section 2.2 focussed on the construct of values and the role these played in mathematics education. The discussion there had contributed to a useful framework with which the professional socialisation of immigrant teachers could be interpreted. However, it is evident from the discussion in that section that values might be defined as isolated qualities distinct from one another (e.g. the several definitions listed in Sections 2.2.1, 2.2.2 and 2.2.5). However, more extensive discussions of values have revealed conceptions of values functioning in sets. Hofstede (1997), Rokeach (1973) and Schlöglmann (2001) had referred to such sets as 'systems', while Krathwohl et al. (1964) used the terms 'value system' and 'value complex' interchangeably. Thus, the discourse

in this thesis had initially adopted the practice of referring to 'personal value systems', such as in the definition of the construct of values as used in this study (Section 2.2.5).

Yet, relatively little appeared to have been researched on the structure of such value systems, and equally little attention had been focussed on the collective function of such a system as an entity. Krathwohl et al's (1964) taxonomy regarded the organisation of a value system as the bringing together of a set of values "into an ordered relationship with one another" (p. 159). The nature of this order was made clear later on in their writing when there was a reference to an individual's 'value hierarchy' (p. 165). The idea of such a hierarchy representing different degrees of internalisation of values was alluded to. It was Rokeach (1973) who made a similar point in more explicit terms, having regarded the integration of individual values into a "hierarchically organized system, wherein each value is ordered in priority or importance relative to other values" (p. 6). In other words, an individual's personal values may be visualised as being internally organised such that different degrees of internalisation of these values are reflected in different levels of the hierarchical structure.

This conception is certainly useful in facilitating an understanding of the ways in which competing and overriding values are related to one another. Interestingly, competing and overriding values appear to have been researched in terms of a meeting of two or more seemingly independent values (see Hofstede, 1997; Lewis-Shaw, 2001), rather than being considered in terms of how these values are organised and related within the value system.

As was evident in the previous chapter, the extent to which the negotiation of perceived value differences could be meaningfully understood in this study had been facilitated by an understanding of values prioritised differently within each individual. This includes the notion of competing and overriding values. Thus, it is helpful to formalise this further by examining how values are possibly ordered within personal value systems. Having conducted this study from the perspective of values, the values documented in this study would also be useful in exploring a structure within which they may be prioritised and organised.

The notion of 'value schema' was referred to in Section 6.2.1.4, in which individual values were perceived to be represented by value branches. A value's distance from the central, core values was also imagined to correspond to the extent to which it is

prioritised. The amalgamation approach to negotiating value differences was thus visualised as involving the relocating of value branches such that those corresponding to values being amalgamated would be equally far from the core. In Section 6.2.1.5, the discussion of the appropriation approach also attempted to represent the interaction of the values involved using the notion of the value schema.

Why was it necessary to develop the term 'value schema' from 'value system'? As the dynamic nature of the valuing process (see Section 7.2) became increasingly prominent in this study, the shift in conceptualisation effectively acknowledged the tendency of the set of personal values to fine-tune its organisation faced with experiencing change and transition. The 'Collins English Dictionary' defines the term 'system' as "a group or combination of interrelated, interdependent, or interacting elements forming a collective entity", yet it is not obvious from the data that personal values prioritised at different levels are necessarily always interrelated, interdependent or interacting. On the other hand, the same dictionary defines a schema as "a plan, diagram, or scheme", which has a connotation of temporariness about it, and which was thus felt to be a more appropriate term to describe the nature of the set of personal values.

Since values which are prioritised differently may possibly be mutually interrelated, interdependent, and interactive, hierarchicalisation with its system of branches and sub-branches may not be an effective representation mode. For example, what does it mean when some value branches are sub-branches of a more internalised value: how are the values in these sub-branches related to one another, and how are these in turn related to other values associated with value branches at the same level?

An alternative representation for the personal value schema will be proposed here. This alternative representation positions values in concentric rings about a central core of the most prioritised values. The further away a particular ring is, the less prioritised the values within it would be. An example of this representation of the value schema is shown in Figure 7.1. For any individual with such a value schema, *honesty* and *creativity* would be part of her core values. *Neatness* and *efficiency* are valued to the same degree. *Technology*, on the other hand, is a value that is not as internalised as *efficiency* and *honesty*, since the ring within which it is located is relatively further from the core. In this mode of representation, overriding values may be regarded as values situated within

Figure 7.1. A representation of an individual's personal value schema.
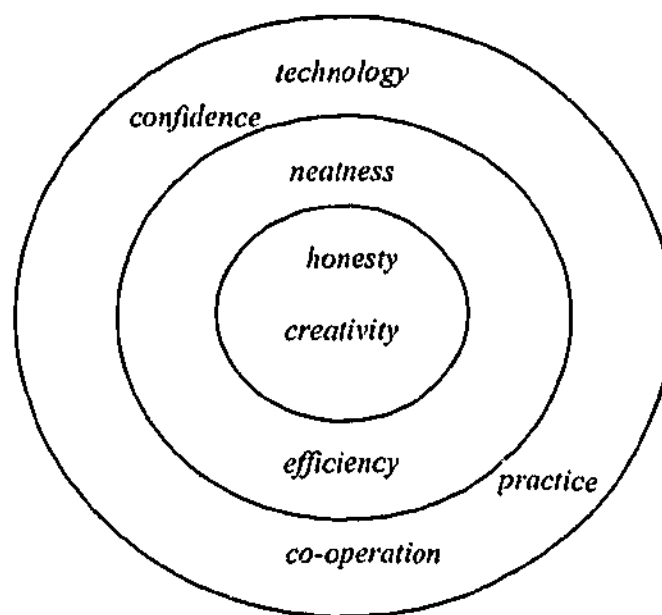
relatively inner rings of the personal value schema. At the same time, that other inner rings of values may exist implies that overriding values are contextualised within the values over which they are embraced, rather than being absolute. This is of course with the exception of core values, since the fact that they are relatively much more internalised implies that they likely override all other personal values.

Nevertheless, that two or more values can be internalised to a similar degree (and located within the same 'value ring') implies that a competition amongst the values can take place, even amongst the core values. These would then be considered as competing values discussed in the previous chapters. Referring to Figure 7.1 again, *neatness* and *efficiency* would be competing values in relation to each other in certain situations where an emphasis of both of these values are implicated.

Of course, the personal value schema for any individual is likely to be more sophisticated in structure, and the task of identifying the schema's constituents as well as how these are internalised relative to one another is understandably not a straight-forward task. While a study such as this which examines situations of value differences has been able to identify some of the competing and overriding values of particular immigrant teachers, such knowledge only identifies the values observed in the study; also, the exact 'location' of these within the individual's value schema may not be immediately obvious.

Figure 7.2. Evaluation and *confidence* as competing values in Carla's personal value schema.
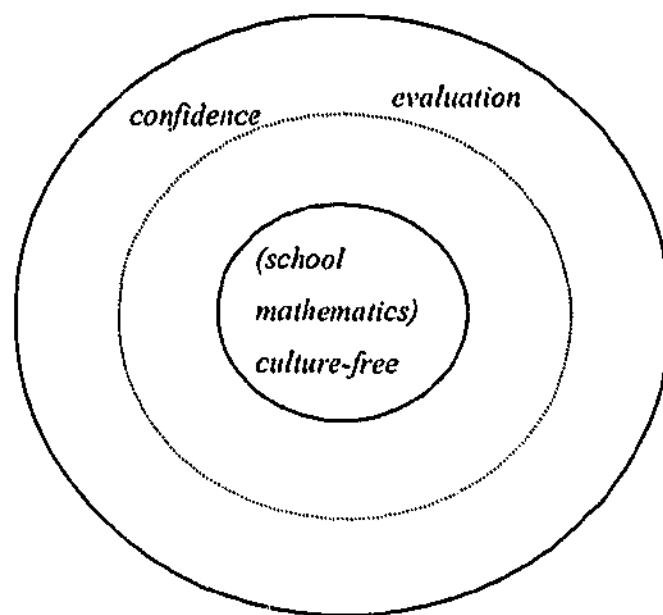
Without the benefit of a longer study which would provide many more value difference situations through which the interaction amongst personal values — and indeed, a more complete range of personal values — may be examined, it can be difficult to map an immigrant teacher's personal value schema. While individual value difference situations may demonstrate how two or more values might relate to each other, continual observations are needed to explore how each of these values play out with other values embraced by the individual. Thus, while the data presented in the perceived value difference of *participation* in Section 5.3.2.2 might enable a representation in terms of Carla's personal value schema to be made as in Figure 7.2, the positioning of *evaluation* and *confidence* as competing values in the same value ring appears to be the only feature that may be proposed with any degree of certainty. Even the relative location of this value ring from Carla's core values cannot be ascertained with the available data, thus the use of the dotted ring in Figure 7.2 to denote its unknown location relative to Carla's core values.

Similarly, a representation such as one shown in Figure 7.3 may be used to summarise the difference between values in Carla's perception of the *computational fluency* situation. But, nothing short of a longer study could enable us to represent all these values within the same personal value schema. It is not possible to examine the existing data to determine with any degree of reliability a more integrated or detailed value schema that describes Carla's personal values.

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Figure 7.3. Competing values involved in Carla's perception of the *computational fluency* value difference.
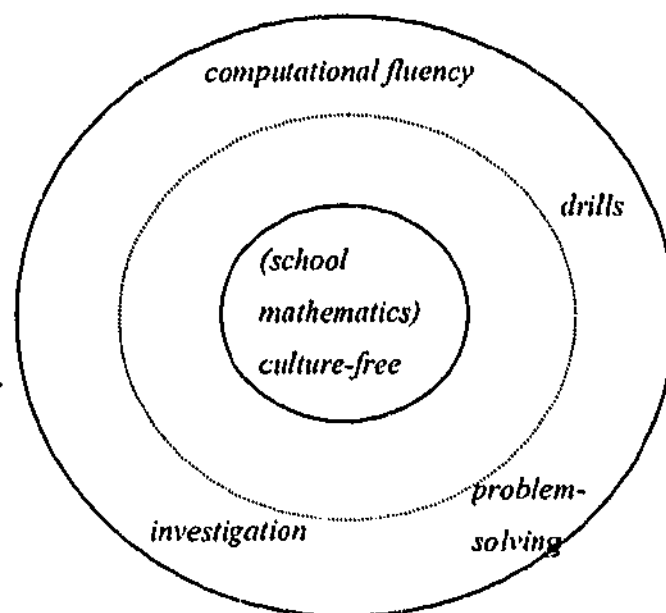
However, this is not to say that the usefulness of this research study should be downplayed. After all, the emphasis of this study is on how perceived value differences have been negotiated by immigrant teachers of secondary mathematics. This difficulty in proposing a value schema that is representative of Carla's professional practice does not imply that the notion of the value schema is untenable. In fact, the data confirms the power of examining values in terms of value schemas. This study also acknowledges how difficult it can be for an individual's personal values to be mapped out, and affirms the strength of the qualitative research methodology to conduct research into values.

7.2 Involvement of Value Schemas in the Valuing Process

The notion of available choice of possible values as an individual undergoes the valuing process (Raths et al., 1987) or organises her personal value schema (Krathwohl et al., 1964) was questioned earlier (Section 2.2.2). Data collected in this study also suggested that the values inculcated within the immigrant teachers arose from the teachers being socialised in their particular home cultures, rather than resulting from choices amongst possible values. There were examples from all the immigrant teachers associating what they valued in their lives and educational experiences in their respective home cultures. The home culture values which the immigrant teachers subscribed to had been internalised as they grew up, went to school, interacted with others, underwent pre-

service training, taught mathematics in schools, and indeed, socialised in that particular culture. Rather than presenting the immigrant teachers with choices, often these experiences appeared to shape the nature of values inculcated in them. For example, Rana's valuing of the practice of writing the solution strategies on the board reflected a norm in Indian classrooms.

Interviewer: In going through the worked examples in your lesson, you listed what I would call 'thinking' steps on the board (Rana: Yes.), and the students would need to translate this into the 'proper' solution in their notebooks. What are your comments on this style of demonstrating worked examples?

Rana: Yes, hopefully, these written strategies that I put on the board would make — help them articulate their solutions better. This practice is common in India, and I have found that students can thus talk about their own solutions very well, like the Chinese [classroom] if I am not wrong.

(RP3: 33-41)

Similarly, it can be argued that Deanne's valuing of *diversity* (and her perception of a difference in its valuing in Victoria) was rooted in the Canadian educational scene she was teaching in:

Deanne: (Referring to some Canadian resources) .... you often see people of different nationalities in the books, whereas in the Australian books, there is very strong 'John', 'Tim' and 'Sarah'. You will come across all sorts of names and things [in the Canadian textbook], which I think is a very good thing which we are lacking here [in Australia]. Particularly, with the refugee situation that we got now, I wonder among the 'kids there's not a lot of tolerances. There are very few cultural differences in the school here, and you have probably seen that. They're all very similar to each other. So that's probably one of the things I want to investigate.

(Referring to a particular question in a Canadian textbook) And here we have 'Takzen has three times as much as Paul'. We are not going to see that in an Australian book.

(Referring to an item in the Canadian textbook) 'Rashid' here. So they made a point in the books, having lots of different names. Even on a test, you have a question like this ....

Interviewer: How do you personally feel about this difference?

Deanne: I think it's a shame that we don't, because Australia is becoming a place where there are a lot more cultural differences .... it is a shame because mathematics is something that is quite universal .... it should be something that ties everyone together, and there isn't that value of the world nature of mathematics here.

(DP3: 1-19, 28-32)

Thus, generalising from this particular study, the unique values which we all acquire in our respective socio-cultural environments are what make each of us Asian, British, Islamic, masculine, professional, or metropolitan, etc. As observed by Krathwohl et al. (1964),

> In the more traditional society a philosophy of life, a mode of conduct, is spelled out for its members at an early stage in their lives. A major function of education in such a society is to achieve the internalization of this philosophy. (p. 165)

Thus, choice is not a pre-requisite for highly internalised values associated with any individual, though its occurrence and role in certain cultures cannot be discounted. Values inculcation in schools through the values clarification process is one such example. Values clarification provides students with the privileging of choices as they consolidate the organisation of their respective personal value schemas.

The possible absence of choice in what Raths et al. (1987) called the valuing process is an important idea in this study, because it is the relative lack of choice when values were acquired in the home culture that possibly made novel experiences such as teaching in a new country susceptible to perceptions of value differences and potentially, value conflicts. Change and transition situations may thus be regarded as opportunities for the structure of the personal values schema to be challenged and redefined. The current state of the personal value schema may be maintained when value differences are negotiated with the status quo, assimilation or affir, y approach, but when the responsive approach is one of accommodation, amalgamation or appropriation, structural changes or modifications to the value schema have to take place. It is the possibility of different ways of value change within the existing value schema that allows immigrant teachers to negotiate value differences with different approaches, thereby broadening the scope for successful and meaningful socialisation.

The notion of value change was discussed in Section 2.2.4, where references to the literature were made in regard to the modification of values as a result of experience and maturity. The notion of value change has also been acknowledged in studies more recently (e.g. Groenfeldt, 2003). As our discussion develops the visualisation of values as value schemas rather than as sets of independently-emphasised qualities, there is a need to fine-tune our conception of the nature of value change. Our understanding of the roles played by competing and overriding values suggests that value change cannot take place in a trivial stimulus-response mode; the greater (or less) emphasis of existing personal values and/or the inclusion of new values can threaten to disrupt the hitherto harmonious relationship amongst the constituents of the value schema. The data collected in this study have demonstrated that as immigrant teachers negotiated their perceived value differences, the accompanying value change was contextualised against a rich socio-cultural fabric, composed of their interaction with students, colleagues, principals,

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parents, curricula, policies, etc in not only the host culture, but often referenced against the home culture as well. Importantly, the immigrant teachers' socialisation experiences imply that value change is triggered by change and transition, not for its own sake, but as a means through which perceived value differences might be mediated and a sense of consonance restored. The resolution of value differences, then, is not just about achieving the harmony of the several individual values involved. Rather, the roles played by the contextual factors in the study indicate that negotiation is also about re-establishing harmony and equilibrium for the entire value schema.

For example, when Carla perceived a relatively less emphasis on *participation* by her students in Victoria (Section 5.3.2.2), she could well have negotiated the difference by (re-)assessing her own valuing of *participation* and responded accordingly, independently of other values she might be holding. Instead, the negotiation process observed was one that took into account her valuing of (student) *confidence* and *self-esteem*. Legitimising these competing values and thus appropriating her responsive approach to this perceived value difference had enabled the outcome to be one that re-established balance in Carla's value schema. On the other hand, her sense of helplessness in resolving some value difference situations related to *power distance*, and the frustration she felt subsequently, revealed Carla's experience of dissonance and conflict when harmony and equilibrium were not successfully restored.

From the perspective of the personal value schema, value change may thus be imagined as movements of values between the concentric rings, or the inclusion of values into the structure. Accommodation can be associated with the promotion of an existing value to an inner ring, or the introduction of a new value into the structure. In the amalgamation approach where two or more values are emphasised equally, some existing values may be 'promoted' to the same level of internalisation as the other values involved in the context, although it is also possible that new values are introduced to be embraced as much as some other values. Appropriation, on the other hand, is likely to be involved with a more complex transformation of the value schema. The interaction of values can lead to existing values becoming more or less internalised at the same time as new values are added to the value schema. Values that are appropriated are likely to be located in the same ring of internalisation, although the extent to which each is emphasised in relation to the others can differ from one situation to the next. The sense of accomplishment amongst immigrant teachers at having successfully mediated value differences, suggested

that such modifications to the value schema restored overall harmony and equilibrium between and amongst values.

How may this dynamic perspective of the personal value schema be associated with Krathwohl et al's (1964) taxonomy of affective educational objectives? If immigrant teachers arrive in Australia with a personal set of epistemological, pedagogical and societal values that already corresponded to the highest level of 'characterisation' (Section 2.2.2) in the taxonomy, the negotiation of value differences surely disturbs this stable state of affairs. Culture shock is experienced. As values are compared, contrasted, synthesised, analysed and re-organised, the value schema may be perceived to operate one level lower, that is, at the 'organisation' stage, as it re-establishes consonance and equilibrium. These processes are complementary and interdependent (Lemin et al., 1994). Over time, as value differences continue to be negotiated and re-negotiated, the value schema's operation may be visualised as alternating between the 'organisation' and 'characterisation' stages.

Instead of treating the value schema as a fixed entity that signifies maturity, its function may thus be viewed as an organised collection of values that exist in dynamic harmony with one another. Phenomena such as perceived value differences are threats to such harmonious relationships among personal values. The negotiation process, with its responsive approaches, is thus a means by which the value schema regains harmony and equilibrium. After all, several schools of thought regard the maintenance of a sense of harmony as human nature. For example, the Confucian philosophy associates harmony to when "a happy order will prevail throughout heaven and earth, and all things will be nourished and flourish" (Confucius, 1961, p. 249). Also, the Piagetian view identified the active role played by the human mental structure in maintaining and re-establishing equilibrium between an individual and her surroundings. Schlöglmann (2001) has also referred to 'stabilised emotional schemata' (p. 8). As the data collected in this study show, a successful mediation process brings about personal peace for the individual. Interestingly, "the Confucian terminology for peace, namely *ho-ping*, is a compound [word] of two ideographs — harmony and equilibrium" (Chew & Lim, 1995, p. 146). This is not to imply that the immigrant teachers subscribed to Confucian values, or that their actions reflected such values. Rather, there appears to be evidence in this study that when value change takes place, this process takes the form of the entire value schema

seeking to achieve a dynamic harmony amongst all constituent values within it, beyond the mere restoration of potential dissonance between any two different values.

The third research question guiding the conduct of this study inquires into the context within which perceived value differences are negotiated by the immigrant teachers (see Section 2.4). While Section 6.3 detailed some of these facilitating and constraining contextual factors, the ensuing discussion of the roles played by competing, overriding and second-hand values serves to further our understanding in responding to the research question. That is, underlying what may be seen to be facilitating or constraining the process of value change is the unique composition of the personal value schema, and the dynamic nature of the relationship amongst the constituent values within.

7.3 Complementarity of Values in the Amalgamation and Appropriation Approaches

It is evident from the discussion in the last section that in situations of value differences, the (re-)establishing of harmony and equilibrium within the personal value schema expresses itself as different responsive approaches to the value differences. This is an important consideration in our endeavour to articulate the findings of this study with regards to the second research question, that is, the approaches adopted by immigrant teachers of secondary mathematics in Victoria to negotiate perceived value differences. This section will very briefly revisit these responsive approaches before devoting itself to two of these approaches (that is, amalgamation and appropriation) in detail.

As we saw in Chapter 5, the 35 responsive approaches adopted by the immigrant teachers to negotiate the 34 reported perceived value differences included all the five conceptualised approaches summarised in Table 2.3, as well as two examples of the affinity approach (see Sections 5.7.2 and 6.2.1.6) and an instance in which the immigrant teacher appeared helpless (see Sections 5.3.2.5 and 6.2.1.6). In general, these may be classified in terms of the degree to which the home culture values have been de-emphasised in favour of values inherent in the Australian society:

- Home culture values fully intact : status quo

  : assimilation

- Home culture values rejected : accommodation

	:	affinity
• Both home culture and Australian values espoused	:	amalgamation
	:	appropriation
• Relationship between home culture and		
Australian values not defined	:	helplessness

The teacher data has demonstrated that regardless of the responsive approaches adopted, the negotiation of perceived value differences is not an automatic process that is void of cognitive and affective involvement. The choice of the status quo approach, for example, is the result of teacher reflection and subsequent conviction of the appropriateness of this approach in the Australian mathematics classroom context. For example, Deanne's continual emphasis in Australia on *diversity* (Section 5.4.2.4) and valuing of *professional support* (Section 5.4.2.5) were not acts of single-mindedness. Nor were they reflective of a lack of cultural sensitivity in Deanne — that would have been paradoxical with her valuing of *diversity*. With *diversity*, say, Deanne's views demonstrated a teacher who was concerned about the moral and ethical development of her students through school mathematics in the contemporary socio-politico environment within which they live (e.g. DP3: 43-47, 72-74). Her valuing of *diversity* was deemed by Deanne herself to be appropriate (and even important) in terms of the role she saw herself in fostering students' positive feeling about — and understanding of — difference and diversity.

Likewise, there is no evidence in the data that the accommodation approach is adopted as a means of avoiding value difference. Rather, the immigrant teachers in this study shared their personal thoughts and feelings that had shaped the choice of this responsive approach. For example, whenever her students pointed out her mistakes, Carla no longer interpreted it as a threat to her authority (as she might were she still in her home culture). Her accommodation approach to a cultural difference in the valuing of *power distance* was evidently guided by personal consideration of other values that played out in the related situation, such as student *confidence*. In fact, Carla's choice of the accommodation approach reflects the importance she placed on maintaining / raising student self-confidence.

There were also the two responsive approaches (i.e. amalgamation and appropriation) which may be seen to be different from the other approaches discussed above, in that instead of the values of either the home or host cultures being affirmed through an immigrant teacher's response, amalgamation and appropriation bring together aspects of both these cultures in ways which also re-establish the harmony and equilibrium of the particular teacher's personal value schema. In this way, they may be perceived as being inclusive responsive approaches: approaches which are characterised by the inclusion, embracing, and mutual support of values from different cultures. On the other hand, the status quo, assimilation, accommodation and affinity approaches may be called exclusive responsive approaches as some values tend to be excluded in the process.

These inclusive responsive approaches of amalgamation and appropriation do not exactly represent the blending of cultural values in the same way that Ninnes (1994, cited in Astill, 1996) used the term 'blending'. In his description, 'cultural blending' refers to the weakening of the home culture through the adoption of aspects of the host culture. Yet, as we have seen in Chapters 5 and 6, adopting either the amalgamation or appropriation approach needs not appear to dilute a teacher's valuing of the corresponding home culture value. In Section 5.8.2, for example, in which Khaliq was reported to have appropriated his perceived difference in the valuing of *respect* in the Australian and Lebanese cultures, his acknowledgement of relatively lesser emphases on *schooling* and *respect* in the Australian society, and of a need for his actions to reflect the Australian cultural values, were balanced against the need for him to embrace what was seen as a worthy value in his home culture, that is, *respect*. In the process, Khaliq had not grown to value *respect* any less than before; rather, the expression of this value seemed to have become contextualised within constraining factors in his workplace and wider socio-cultural space.

Thus, if anything, both the amalgamation and appropriation approaches serve to enrich both the home and Australian (host) cultures, possibly through the choice of a 'middle way'. Yet, this middle way is not about adopting a compensatory value which is seen as acceptable or desirable in relation to existing norms and practices in different cultures, for that would probably involve the rejection of the conflicting values and the acceptance of a new value in the first place. In the case of amalgamation, there may be the embracing of both cultures' values as they are. As discussed in Section 6.2.1.4, the newly-acquired Australian value may be visualised as being added alongside the

corresponding home culture value such that both are emphasised but without altering the nature of the individual values. All values concerned may be seen as occupying the same ring within the personal value schema. From the observer's point of view, the two amalgamated values can be identified as distinct and separate qualities. Analogically, this is similar to the chemical formation of mixtures (versus compounds): the constituents of a mixture remain distinguishable and separable although they together have produced something new.

The appropriation approach is different, however. The way this approach had been conceptualised in Section 2.3.2, and the fact that its articulation was observed in all but one of the participating teachers in this study, suggest that the home and Australian values causing the dissonance initially had actually interacted with each other in harmonious ways. The introduction of the new Australian value to the value schema is accompanied by a personal definition of this new value with respect to the corresponding traditional value. For example, when Manoj grew to understand the relatively looser connection between academic performance and personal success in the Australian culture, his approach to negotiating a perceived difference between the cultures in the valuing of *academic achievement* was one of appropriating it to optimise its relevance in the Australian classroom. While Manoj remained committed to the importance of *academic achievement* in enabling an individual to meet the challenges of life demands and career choice, he no longer expected all his students to be performing at the same high level. Instead, there appeared to be an interaction between *academic achievement* with the Australian value such that the importance became manifested as one of 'each to her best potential', whether that potential was to be 90% or 60% of measurable achievement (MP3: 466-515).

In other words, Manoj's appropriation of his valuing of *academic achievement* was an ongoing process. With approaches like accommodation or assimilation, the individual makes a decision and the relevant values are embraced or de-emphasised in similar situations in future. With appropriation, however, the balance of emphasis between values changes with each classroom situation, and the individual needs to assess the degree to which one value will be more emphasised relative to the other relevant values in each of these situations. Thus, the values that are being appropriated are constantly interacting with each other. An observer may sense aspects of the different cultural values being embraced, but would probably find it difficult to isolate them. Decisions and actions

portraying the home culture's values also demonstrate aspects of the Australian values, and vice versa. Using the analogy of chemical formations again, this approach is akin to the production of compounds (as contrasted with mixtures). While the properties of the constituents may be distinguishable in the nature of the compound formed, it would be impossible (in the scientific sense) to isolate the constituents from the compound.

It is significant to remind ourselves that the amalgamation and appropriation approaches together represent the most commonly-adopted responses to cultural/value difference, in the context that the studies were conducted with teachers with different home ethnicities. At the same time, it also needs to be put into perspective that the 15 instances in which these inclusive responsive approaches were adopted in this study may not be significantly more than the 12 other instances when the immigrant teachers' responsive approaches served to preserve the home or host culture values. Another way of highlighting the extent to which these inclusive approaches had been found useful is to note that no other group of responses was adopted by all the eight immigrant teachers. Similarly, in Fast's (2000) account of his mathematics teaching experience in Zimbabwe, the range of approaches he adopted to negotiate perceived value differences included appropriation. Also, in Chew and Lim's (1995) study with ethnic Chinese business managers, the most preferred conflict resolution mode was the compromising style, exemplified by such actions as "I try to find a fair combination of gains and losses for both of us" (p. 147).

That all the immigrant teachers participating in this study had found the inclusive approaches of amalgamation and appropriation to be appropriate during their professional socialisation into the Victorian mathematics classroom is significant, in that this has implications towards the appeal and suitability of responsive approaches that recognise the strengths and power of different cultural practices and traditions. The choice and adoption of approaches that amalgamate or appropriate values that have been perceived to be in conflict may perhaps be one way in which modern-day societies may re-define themselves, metamorphose and progress in an age of globalisation and internationalisation, and in a period of conflicts between political / religious ideologies.

Negotiating perceived value differences with the amalgamation or the appropriation approach, however, should not be equated with the practice of cultural pluralism. The immigrant teachers may have become increasingly cultural relativistic, as Manoj probably

did (to be discussed in Section 7.4), where there is a recognition that phenomena can be and are interpreted in different perspectives by different cultural groups. On the other hand, this study adopts Groenfeldt's (2003) view that cultural pluralism helps an individual to perceive cultural diversity differently; it acknowledges and accepts plurality of worldviews and perspectives. Furthermore, cultural pluralism as a worldview would be expected to influence all the responsive approaches adopted by any individual. In fact, if different cultural perspectives are considered to be equally valid instead, it can be difficult to imagine the individual negotiating value differences with either the culture-free or accommodation approaches. Yet, both these two responsive approaches have been seen to be adopted by the immigrant teachers.

What the inclusive responsive approaches of amalgamation and appropriation epitomise, however, may well be the notion of complementarity. The idea of complementarity was first mooted by physicist and Nobel Laureate, Niels Bohr, in the 1920s to account for the different possible modes of describing the atomic electron. Bishop (1988) applied this notion in his discussion of the socio-cultural approach to mathematics education research. He considered the six mathematical values he conceptualised as three complementary pairs, namely, rationalism/objectism, control/progress, and openness/mystery. Although the values within each pair appear to contradict each other, they may also be viewed as complementing — and supporting the valuing of — each other. That is, complementary concepts may be mutually exclusive, but yet both are required in order to enable a holistic description and understanding of particular situations.

The approaches of amalgamation and appropriation to negotiate perceived value differences appear to demonstrate this idea of complementarity. Deanne's adoption of the appropriation approach (see Section 5.4.2.1) to mediate a conflict between the values of *precision* and *confidence* is illustrative of this. While teacher expectation of students to use more technical, mathematical language in class and in their work may be seen by some to be a possible threat to student self-esteem and confidence as mathematics learners, Deanne's response had shown how these apparently opposing values may also be harnessed to support each other. The quote below, for example, reveals how, to Deanne, student valuing of *precision* in their mathematical language and discourse can support the fostering of greater *confidence* amongst themselves as learners of

mathematics:

> Because I think it's another thing that helps those weak kids, if they are using the language of
> mathematicians, and sounding like mathematicians, then they get a sense of doing it, being part of
> that mathematicians' community. For some of them, maybe the language part is the part that they
> grasp, because they might be strong linguistically. So if they're getting the right terms and using
> the right words, they are part of that community .... That will raise their confidence levels, because
> then they may not understand the big, long equation on the board, they know when I say
> 'derivative', they know what that is. So they are already involved at that level, and ready to move
> on. (DP2: 238-249)

On the other hand, it is possibly easier to imagine how student *confidence* supports
the valuing of *precision*. A student would be expected to be reasonably confident with his
mathematical performance to be using precise mathematical language in speech and in
writing. Thus, Deanne's decision to value both *precision* and *confidence*, instead of
attempting to affirm the valuing of only one of these values, provided her with the
opportunity not only to articulate what was emphasised in both the Australian and
Canadian mathematics classrooms, but also to strengthen the valuing of each of these
attributes.

Betty's amalgamation of *efficiency* and *beauty* in the value difference of *technology*
(see Section 5.7.2) is another example. While the pursuit of *beauty* in mathematical
practice through paper-and-pencil activities could be perceived to be in conflict with time
saved through valuing *efficiency*, Betty had developed an appreciation of how both might
be emphasised in complementary ways. Clearly, her valuing of *efficiency* (and of
technology) did not signal the demise of her valuing of *beauty*. In fact, these two values
were observed to be effectively supporting each other. For her, *efficiency* could well go
hand-in-hand with *beauty*, since student practices that are efficient invariably bring about
the 'aha' moment, and have the potential to stimulate them to appreciate the *beauty* that is
inherent in mathematics. On the other hand, it is also possible to perceive *beauty* as
supporting the valuing of *efficiency*. Isn't it through the pursuit of elegance and beauty in
mathematical reasoning that efficient ways of doing mathematics are often discovered?
For example, one can imagine how interpreting the sum of the first one hundred positive
integers (i.e. $1+2+3+...+99+100$) as 50 groups of 101 might have been an exercise in
discovering the *beauty* inherent in number patterns. At the same time, this knowledge —
and especially the generalisation of this knowledge to the first n positive integers —
promotes the valuing of *efficiency* in computations as well. Thus, although these two
values of *efficiency* and *beauty* may be seen as contradicting each other, such as in the
context of time constraints during mathematics lessons, Betty has demonstrated how they

might also be embraced collectively in ways which effectively enable each to support the valuing of the other within the individual, and by her students.

That all the eight immigrant teachers participating in this study were observed to be adopting one or both of the two inclusive responsive approaches at some time, and that these teachers also responded to other perceived value differences with other approaches, implies that the use of these approaches is probably not related to the presence of some specific factors at the individual or environmental level. Rather, it was more likely that factors facilitating or constraining the adoption of amalgamation and appropriation approaches might have been unique to the particular value difference situations, contextualised in the teachers' own professional experiences and in the cultures in which relevant values were seen to be in contrast. That is, although there is no evidence (as discussed earlier in Section 6.3.3) that the relative dominance of facilitating or constraining factors determined teacher choice of responsive approaches, what constituted as facilitating or constraining factors might influence such a choice of responsive approach.

Thus, Saka's amalgamation approach to negotiate the value difference of *technology* was chosen in the context of his belief that students needed to continually exercise their brains (which supported his home culture values), and his observation that mathematics learners in Australian schools had been too reliant on the calculator (which supported the Australian value of *technology*). These facilitating and constraining contextual factors might possibly have provided the basis upon which Saka amalgamated the values of *technology* and *thinking* or *mental exercise*. Similarly, when Carla appropriated her perception of a difference in the valuing of *participation*, the process took place in the context of her desire to evaluate student learning, against her perception that Victorian students' relative low confidence made them feel embarrassed about volunteering responses. Thus, Carla's appropriated practice allowed her to assess student understanding and competence while maintaining the students' self-confidence in participating in class. As we saw in Section 5.3.2.2, Carla explicitly assured her students that it was human nature to make mistakes, thus demonstrating her efforts to also foster a non-threatening learning environment within the classroom, one in which students might be less worried about saying 'the wrong thing' during their mathematics lessons. In these and other situations of perceived value differences when the immigrant teachers concerned responded with either the amalgamation or appropriation approach, there

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appeared to be favourable environmental factors that together presented the teachers with both facilitating and constraining forces. Compared to the other approaches (i.e. status quo, assimilation, accommodation, affinity), these inclusive responsive approaches are certainly more cognitively challenging to adopt. Professional practice that amalgamates or appropriates values from different cultures is certainly not as easy as making a choice of embracing particular values at the expense of the emphases of others. A significant feature, however, is the potential for the fostering of new cultures afforded by amalgamation and appropriation. These approaches are creating opportunities whereby different values can continue to be embraced across cultures, but in useful ways which support culture reproduction and growth, as well as culture preservation.

7.4 Teacher Development of Cultural Relativism in the Context of Ethnocentrism

So far, in this chapter, we have discussed theoretical ideas related to the personal value schema, as well as the complementarity of values demonstrated through the inclusive responsive approaches of amalgamation and appropriation. This next section will explore the possibility of changes in an individual's responsive approaches to perceived value differences over time.

Granted, the methodological design of this study has meant that the involvement of the personal value schema in an individual's choice of responsive approach is examined at only a few periods of the immigrant teacher's professional life. In particular, these correspond to situations of perceived value difference during the lessons visited. Studies reviewed in Section 2.3.3 were also focussed on how ethnic minority and immigrant teachers negotiated cultural differences at different points in time, rather than on how such negotiation approaches or patterns possibly evolved with accumulated experience in the teaching profession.

Hofstede's (1997) conceptualisation of the 'acculturation curve' (see Section 2.3) might point to the possibility of the immigrant teacher attaining the 'stable state of mind' eventually. However, there has been no evidence in this study that professional experience in the host culture acted as a factor of the frequency with which value differences in the mathematics classroom are perceived. Specifically, the more experienced immigrant teacher participants of this study, namely Li Kang, Manoj and Rana, were found to be continuing to experience dissonance as novel value differences were being perceived.

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What stood out from the collected data was a somewhat unexpected aspect of Manoj's response to perceived value differences. While his extensive years of teaching experience in Victoria might have helped him to hone his skills at responding to perceived value differences, what was really surprising was that he appeared to be displaying a sense of detachment in his response to value differences at the time of the study (as discussed in Section 6.3.6). Manoj appeared to negotiate the value differences through assessing, comparing and evaluating beliefs regarding mathematics, education, and mathematics education in both Australia and Fiji. Differences in values did not appear to have been examined at the micro-level of events, or with regards to his emotions about these events, even though these incidents probably triggered off his affect in the first place. Thus, value difference negotiation did not seem to be referenced against values embedded in different cultural practices and norms. Rather, the values underlying different philosophical and pedagogical beliefs seemed to have been guiding Manoj's sense-making of the perceived differences. Instead of responding to value differences by considering 'what is', Manoj's actions appeared to consider 'what ought to be'. In this sense, it is as if Manoj was demonstrating an awareness of cultural relativism, where there was a consciousness that what he observed in his environment (in this case, the culture in Victoria) could be interpreted on the basis of what the 'locals' valued. Cultural relativism recognises that the same phenomenon may be interpreted differently with legitimacy in different cultures (see, for example, Groenfeldt, 2003). Whether Manoj's 27 years in the Victorian mathematics education system was a crucial contributing factor was not clear from this study, although the role played by time in the cultivation of this valuing and practising of *cultural relativism* was evident from quotes like the following:

> I think, as I say, I think over the years, your _ own style changes. When I came initially from home to here, the way you think, the way you _ sort of teaches slightly _ devalue time, includes ethics, that's unethical, teaching practice as are practised here, which was for the better, I think, myself, that I have learnt a lot. I have learnt to be tolerant, as I said, and to accept people as they are. I think we were sort of _ restricted way of thinking. I think here it's sort of what you call open-minded, slightly different. (MP3: 454-461)

In this way, it may be easier to understand Manoj's range of responsive approaches, given that the status quo, accommodation and appropriation approaches Manoj adopted for value differences are conceptually very different from one another. His cultivation of an 'open-mind' might well have allowed him to consider difference as diversity situated in different cultural contexts, heightening Manoj's awareness that norms and practices (and the values and beliefs underlying these) were not absolute, and that their legitimacy

might be socio-culturally interpreted. Cultural relativism "does not mean that one must give up one's identity, values, or culture" (Winkelman, 1994, p.123), and the data in this study clearly show that the personal value schemas of immigrant teachers like Manoj continued to affirm some aspects of the cultures of their respective home countries.

Another way of interpreting Manoj's valuing of *cultural relativism* over time, and a way of understanding the affective states of immigrant teachers in the face of value differences, is to suggest that the first years of professional practice in a host culture inevitably bring out feelings of ethnocentrism. Ethnocentrism has been identified in Section 2.3.1 as a factor influencing the quality of an immigrant teacher's socialisation process, and it appears from the quotes there that ethnocentrism was not only associated with a sense of loyalty and pride amongst the 'insiders', but also a feeling that the 'outsiders' are somehow inferior as well. Sumner's (1906) description that

> each group nourishes its own pride and vanity, boasts itself superior, exalts its own divinities, and looks with contempt on outsiders. Each group thinks its own folkways the only right ones, and if it observes that other groups have other folkways, these excite its scorn. (p. 13)

is thus echoed by other researchers over the years (e.g. Cashdan, 2001; Eckermann, 1994). Indeed, the data collected are not short of examples in which discourse was marked by comparisons of what were observed in Victoria and what would be the case in the home culture. For example, does Rana's opinion below imply the presence of a sense of ethnocentrism in her professional practice?

> Interviewer: Do you think you use much more deeper [language,] in terms of terminologies and conceptual terms, in India in your teaching?
>
> Rana: Absolutely yes, oh yes! This would be considered baby language, you know. This would be considered like skimming through a course.

(RP1: 128-132)

Was Rana, then, feeling superior about the Indian mathematics education system, and subsequently devaluing the legitimacy of the Victorian mathematics education system? This is not likely so, for if Rana had felt that what she observed in the Victorian mathematics classroom to be inferior to what was practised in India, she would not have negotiated a majority of her perceived value differences with the appropriation approach.

Rather, while the immigrant teachers might have been ethnocentric with regards to their views of what they observed in their respective sites of professional practice in Victoria, this sense of ethnocentrism might be due to what Carla attributed to in the

statement below:

> Of course I have [my] own way, the way I was taught, the way I do things in Romania. So that comes back to me all the time. 33 years I lived there, so 33 years I used maths in that certain way. (CP3: 24-26)

For Carla, her 'own way' was cultivated through her life experience in Romania, and was sufficiently internalised so that it 'comes back to me all the time', such that it became a frame of reference against which sense-making of the new reality could be facilitated.

Differences in the way the (mathematics) discipline, its pedagogy, and education in general played out in the home and Australian cultures, then, appeared to be interpreted with an awareness of cultural difference across geopolitical borders, even if many of these teachers might have thought that mathematics teaching was culture-neutral initially. As the quotes below illustrate, and difference observed was viewed in terms of cultural difference, reflecting a case of 'this is different because of the different mathematics education systems', rather than 'this is different because of an inferior mathematics education system in Victoria':

> Rana: So they [in the Indian education system] build [sic] them [i.e. problem-solving] in, but under exams conditions. Here, it's — we don't really care that you work with someone else to get your solution, provided you understand it. That's the attitude here. Over there, it has to be yours, because you are going to be assessed on it. It must be some overt kind of answers. And you can't get help for — you must do it by yourself. That's a big difference. So group work is encouraged here. Group work is not encouraged there. (RP2: 105-110)

> Li Kang: My expectation [when I first came to Victoria], well, I think that the, if I teach at year 10, right, I expect the student to be of year 10 standard. If I teach year 11 I expect students to be at year 11, year 9 the same. But no, because over here...in Malaysia when you teach a particular year level, year 7, year 8, year 9, you must finish the curriculum of that syllabus for that year. (LP1: 338-342)

> Manoj: Absenteeism is a problem. See, in that way, they [in Australia] are very relaxed about education. Not like us [in the Indian culture] …. Here, the whole culture is different, that _ it takes a while to come to terms with it. (MP3: 44-48)

Nevertheless, Sumner's (1906) definition of 'ethnocentrism' has helped us to explore in general the nature of ethnocentric feeling which the immigrant teachers might have. More recent definitions of 'ethnocentrism' may actually further validate the nature of the immigrant teachers' interpretations and actions as ethnocentric. For example, LeVine and Campbell (1972) defined ethnocentrism as "the self-centred scaling of all values in terms of the ingroup folkways" (p. 8). Anthropologist Ken Barger proposed that "ethnocentrism

can be defined as making false assumptions about others' ways based on our own limited experience" (Barger, 2003).

As mentioned earlier, this discussion on ethnocentrism was initiated to provide another way of understanding Manoj's valuing of *cultural relativism* over the years of teaching mathematics in Victoria. Manoj, like the other immigrant teachers in this study, might have interpreted value differences in terms of his home culture, but any sense of ethnocentrism was probably not accompanied by a feeling that the mathematics education system in Victoria was somehow more inferior or inadequate. Rather, these teachers (including Manoj) developed an awareness that meaning and valuing are grounded in the respective cultures in which phenomena take place. As Manoj said,

> It's always been that _ emphasis _ in our _ thing, you know, like in our culture, so it is very very important .... I mean, I appreciate their value [in Australia], I mean, of course, some of their values don't agree with mine, but I look at it. (MP2: 300-307)

While not being complementary (in the same way that complementarity was described in Section 7.3), it is certainly likely that immigrant teachers' professional socialisation may be characterised by a mixture of *ethnocentrism* and *cultural relativism*, with a possibility that the former gradually became less significant with the increasingly greater emphasis of the latter over time in the host culture.

The possible development within an immigrant teacher of *cultural relativism* over time in a host culture (as observed in Manoj in this study) has relevance to responding to the third research question, that is, relating to the context within which different perceived value differences were negotiated satisfactorily by the immigrant teacher. This can only be tentatively proposed, given available data of this study, and it would thus be of academic and practical significance to investigate further the nature of such development within the immigrant teacher. Is the inculcation of *cultural relativism* a natural by-product of immersion in a host culture? How does the relative status of the home culture to the host culture possibly play a part in this development? What are the facilitating factors, or the constraining ones, that might operate in the professional environment within which the immigrant teacher practises? These and many other related questions are worth researching in subsequent, follow-up studies.

This chapter has built on the discussion of the results in the previous chapter. Specifically, theoretical examination of the following constructs has been made in this chapter:

— the notion of the personal value schema, how it plays an active role in the valuing process, and how the negotiation of perceived value differences reflects the maintenance of harmony and equilibrium within this schema,

— the prevalence of the inclusive responsive approaches of amalgamation and appropriation in the teachers' negotiation of perceived value differences, and how these approaches highlight the possibility for seemingly conflicting values to co-exist in complementary ways,

— the possibility for the immigrant teachers to cultivate a sense of *cultural relativism* as they accumulate experience practising in the Victorian secondary mathematics classroom.

These discussions have contributed to a fuller understanding of how the research questions of this study might be answered, some main points of which will be included in the next chapter. The practical implications arising from the discussions in this and the previous chapter will be highlighted in this next, last chapter. At the same time, suggestions for how academic knowledge and understanding related to values and professional socialisation in mathematics education may be further explored will be offered.

CHAPTER 8

CONCLUSIONS AND IMPLICATIONS FOR FURTHER RESEARCH AND PRACTICE

The presentation of the data analysis in Chapter 5 has been followed by a discussion of the findings in Chapter 6, and then by a theoretical analysis of selected important constructs in Chapter 7. Through these three chapters, the reader might have discerned how the data collected in this study has provided responses to the research questions posed at the end of Chapter 2. The nature of qualitative research methodology, reflecting the different ways phenomena are interwoven and possibly interpreted, has meant that any substantive response to each of the research questions cannot be made in a few sentences alone. Thus, the optimal way of examining how the current study has answered the research questions might be through a (re-)reading of Chapters 5 through 7, thereby allowing the discussion and analysis to present a coherent response on their own accord.

In other words, any attempt at summarising the last three chapters with the aim of answering the research questions risks presenting a reductionist view to educational research, and also risks downplaying the significance of the socio-cultural context within which the solutions are 'obtained' and in which these are grounded. Nevertheless, it is felt that this last, concluding chapter should begin with a brief summary of the responses to the three research questions. As long as the reader remains mindful that these do not represent in any objective sense 'answers', but responses that have meaning within a socio-cultural context of researching and teaching, and that these meanings are best constructed through a perusal of Chapters 5, 6 and 7, this exercise presents how my research perspectives have shaped my interpretations of — and responses to — the research questions in some coherent way. The major constructs that possibly underpin the findings will also be mentioned in the summary.

This chapter will then move on to focus on the more practical aspects of the teachers' socialisation experience. In this way, this last chapter may be considered to be complementing Chapter 1, which featured the rationale for embarking on this study. In particular, the unique features of the Victorian mathematics curriculum that were especially visible to the immigrant teachers of secondary mathematics will be identified. The increasing significance of values teaching through mathematics in the current climate

of major curricula changes will be discussed next. After this, the writing will focus on what the findings of this research study mean in the context of fine-tuning and facilitating the professional socialisation experience of future immigrant teachers of secondary mathematics in Victoria.

This will then lead on to a proposal of suggestions for further, related research into values, or teachers' professional socialisation in the context of mathematics education. While it is likely that the current study has led to the conception of some new knowledge in most — if not all — of these three fields of study, the defining of new frontiers invariably uncover more uncharted territories for exploration, examination and scrutiny. In concluding this thesis report, it is the hope for the continual quest for knowledge and understanding with which these suggestions will be made.

8.1 Conclusions Regarding the Initial Research Questions

The conduct of the present study into the professional socialisation experiences of immigrant teachers of secondary mathematics in Victoria was guided by a series of research questions, themselves arising from a survey of current academic knowledge and posed in Section 2.4. A summarised form of responses that have been informed through the data collected and analysed in this study will now be presented, to serve as a marker of significant constructs underpinning the fuller understanding of the findings of this study.

8.1.1 Research Question 1: Nature of Value Difference

The first research question guiding this study was: **What is the nature of value differences perceived by immigrant teachers in the Australian secondary mathematics classroom? In view of the hitherto virtual absence of value conflict research in mathematics teaching/learning, to what extent are the value differences perceived directly related to mathematics and its pedagogy?**

The eight immigrant teacher participants reported a total of 34 perceived value differences over the data collection period. The nature of these value differences may be categorised as being mathematical, mathematics educational, general educational, and organisational. Despite the socio-cultural nature of mathematical knowledge (Section 2.1.1), there appeared to be a feeling amongst these immigrant teachers that the discipline is pan-cultural. Amongst these categories of value differences, the mathematics

educational ones were most frequently reported in this research study. Differences in the way different cultures facilitate the teaching and learning of school mathematics were found to take place across intended, implemented and attained curricula. On the other hand, half of the general educational value differences perceived by the immigrant teachers were reported by several teachers, all of whom positioned Victoria's education system as consistently higher (or lower) in emphasising the values involved. The only two examples of organisational value differences, interestingly, related to aspects of *support* provided to teachers of mathematics.

Not all the value differences perceived by the immigrant teacher participants led to dissonance and conflicts, however. There is evidence in this study that teachers' epistemological, pedagogical, educational and organisational values need not necessarily be aligned with what were valued (or not valued) in their respective home cultures. The finding that the notion of choice is likely not a part of the valuing process implies opportunities for consonance as well as dissonance with the host culture.

Is cultural distance (Dawe, 1982) a determinant of successful socialisation? After all, Allan's (2002) study into the induction experiences of students in an international school echoed this point, where "the nature of this [students' interaction with their peers] could be seen to vary according to nationality. North American and British students experienced the least cultural dissonance" (p. 75). In this study, the two smallest cultural distances pertained to the English (Betty) and Canadian (Deanne) cultures. Yet, there is no consistent evidence from their data that both experienced less value differences (see Appendix 17) than their peers from other cultures. In fact, as explained in Section 5.7.2, if Betty had not taught across educational systems of schools as well, she might have reported even more value differences between the English and Victorian mathematics education systems. In other words, the findings of this study imply that insofar as teacher professional socialisation is concerned, cultural distance does not appear to be a factor of opportunities for perceived value differences.

Specifically, in relation to mathematics education, this study has shown that more value differences pertaining to mathematics pedagogy were perceived than any other categories of such sources of potential dissonance, although mathematics as a discipline appears to be regarded as pan-cultural and thus relatively free from perceived difference. This validates the proposal in Section 1.4 that teachers of mathematics may migrate

overseas (and to Australia) in the belief that the teaching of a culture-neutral subject such as mathematics should be problem-free, essentially and potentially rendering these teachers ill-prepared to negotiate any value difference they might come across in the host culture.

8.1.2   Research Question 2: Approaches to Negotiating Perceived Differences

The second research question for this current study was: **What are the approaches adopted by immigrant teachers to cope with and/or negotiate perceived value differences as part of their own professional socialisation process? What are the underlying assumptions, and how are these approaches displayed in observable ways? To what extent have these approaches been reflected in the conceptualised model of teacher approaches discussed earlier (see Table 2.3)?**

Analysed data in this study has built on a conceptualised set of teacher responsive approaches (as shown in Table 2.3). These data had facilitated the further development of a range of responses, and the renaming of one approach, which the teacher participants were observed to adopt in response to perceived value differences. Table 6.1 is reproduced below as Table 8.1, summarising the features of the status quo, assimilation, accommodation, amalgamation, appropriation and affinity approaches, as well as of, the helplessness response. It is noted, though, that this listing does not represent a sequence through which it is desirable for one's socialisation to mature. For example, Table 8.1 does not suggest that amalgamation is a better responsive approach than accommodation or affinity. Rather, as was observed in the study, each immigrant teacher participant had been observed to adopt multiple approaches as the contextual factors underpinning the value differences changed.

Table 8.1

Repeat of Table 6.1: Responses by immigrant teachers to perceived value differences in mathematics education

Culture to which personal value is aligned	Response	Assumption	Teaching
Australian culture	Affinity	There is no culture conflict; my value is aligned with the Australian culture.	The Australian culture supports my mathematics teaching style.
Home culture	Helplessness	There is no apparent way to negotiate the different values satisfactorily.	My mathematics teaching style may not be consistent, and I may not know what to do.
	Status quo	My home culture should be espoused.	I teach mathematics in the same way I did in my home culture.
	Assimilation	The Australian culture should influence the surface characteristics of my mathematics teaching.	I include the Australian cultural contexts in my teaching, such as in examples and problem sums.
	Accommodation	The Australian culture should be espoused.	Planning and classroom decisions portray the Australian culture.
	Amalgamation	The essence of my home culture and the Australian culture should guide mathematics teaching.	My teaching reflects a synthesis of teaching styles from my home culture and from Australia.
	Appropriation	My home culture and the Australian culture should interact to inform my mathematics teaching.	My mathematics teaching style consistently reflects an adaptation of my home culture to local norms and practices.

It is significant to note that the demonstration of the status quo approach was not restricted to newly-arrived immigrant teachers only; Manoj with 27 years of experience mathematics teaching in Victoria made use of this approach to negotiate several value differences as well. That is, the adoption of the status quo approach does not likely reflect lack of socialisation experience or lack of resources with which to work round perceived value differences.

As for the assimilation approach, the three teacher participants who adopted this approach in different value difference situations were not observed to have used the status quo approach in other situations. This hints at the possibility that assimilation may be chosen instead of status quo to enable individuals to continue embracing particular home

culture's values. While the accommodation approach (along with other approaches) was exhibited by several teacher participants, one of the questionnaire respondents demonstrated the possibility for immigrant teachers with unique life / professional experiences in their respective home cultures to totally embrace the Australian way of life, and the values underpinning this (see Section 6.2.1.3).

The amalgamation and appropriation approaches have been differentiated from the approaches discussed above, having been considered to be inclusive (see Section 7.3). As a group, these inclusive responsive approaches were the only ones adopted by each of the teacher participants in this study. The way in which these approaches are different from each other has been discussed with the analogy of the properties of chemical mixtures and compounds (see Section 7.3). In an unique way, the appropriation of values represents the ongoing and active interaction of these values within a teacher's personal value schema. The paradoxical mutual support of different cultural values that is characteristic of the amalgamation and appropriation approaches essentially epitomises the notion of complementarity (see Section 7.3). The potential for these approaches to enable societies to re-define and to develop was acknowledged.

There are two examples amongst the immigrant teacher participants and the questionnaire respondents in which the teachers were clearly helpless in the face of two of the value difference situations. That these teachers were still practising in the profession indicates that continual service in the teaching profession does not necessarily imply successful negotiation of all perceived value differences. In particular, Carla's experience in this instance indicated that contextual factors play an important role in rendering teachers helpless, given the perception of similar value differences —and her different approaches to negotiate these— in different contexts.

The different contexts within which similar value differences were perceived (even by the same teacher) demand different responsive approaches. In general, the range of responsive approaches (as shown in Table 8.1) demonstrates different teacher assumptions in the context of the unique socio-cultural framework. These assumptions may include a feeling of 'no way out' (helplessness), to a need to espouse the home culture (status quo, assimilation), or to portray the host culture (accommodation, affinity), and to a desire to espouse both the home culture and Australian values (amalgamation, appropriation).

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The 6 responsive approaches (i.e. excluding helplessness, which is a response) have been displayed overtly in the decisions the immigrant teachers subsequently made, and in the choice of course of actions. Although the composition of the individual value schema may not have been affected in the status quo, assimilation and affinity approaches, the nature of the other three approaches has meant that each immigrant participant's personal value schema is reoriented somewhat as a result of professional socialisation.

8.1.3   Research Question 3: Contextual Factors

As formulated in Section 2.4, the third set of research questions was: **What are the operating contextual factors that interact to guide teacher choice of responsive approaches? In particular, what are the roles played by competing, overriding and second-hand values?**

The contextual factors that were operating in the value difference situations were varied (see Appendix 17), and it is significant that they were not just pedagogical or epistemological in nature, but also historical, political, societal, and economic. These provide convincing validations of the socio-cultural nature of school mathematics teaching and learning.

The choice of responsive approaches to perceived value differences appeared to be informed by factors situated within such rich socio-cultural contexts. There has been no evidence, however, that the relative proportion of facilitating and constraining contextual factors determined such choices. On the other hand, choice of responsive approaches was probably regulated by the different beliefs and values underlying these contextual factors, and the mediation amongst them (the beliefs and values) within the individual's personal value schema.

At the same time, the number of years of professional socialisation is likely to be a factor in cultivating within the immigrant teacher a sense of cultural relativism, thus privileging her with a set of lenses with which future perceived value differences might be interpreted.

Competing, overriding and second-hand values were discussed in Section 2.2.3, and examples of these operating in the different value difference negotiation processes have been documented in Chapters 5, 6 and 7 (e.g. Sections 5.7.2, 5.9.2, 7.1, 7.2, and more extensively in Sections 6.3.4 and 6.3.5). That there has been no clear relationship between

the operation of any of these values and the choice of responsive approaches in the different negotiation processes is an indication of the complexity underlying the influence of these values on successful socialisation experience. What appeared to be evident, though, is a validation of the function of value schemas, over the alternate view of a collection of isolated, single values involved in the process of negotiating perceived value differences. In fact, each of the responsive approaches may be described and distinguished in terms of the introduction or re-orientation of values amongst the concentric rings of values in any one such schema.

The notion of the personal value schema may indeed be considered to be the main contextual factor in itself, for it was consistently observed that any of the teacher's negotiation of values in difference (incorporating choice of responsive approach) was really an articulation of the personal value schema seeking to re-establish harmony and equilibrium amongst its constituent values. Regardless of the number of contextual factors operating in any value different situation, and regardless of whether these are facilitating or constraining the continual espousal of values related to the home cultures, it has appeared that it is how the underlying valɹɹ s are prioritised within the personal value schema that more directly influences choice of responsive approaches. The centrality of values (and value schemas) is thus a significant variable in the professional socialisation process of immigrant teachers of mathematics in the Victorian secondary classroom.

8.2 Unique Features of the Victorian Mathematics Curriculum

As discussed in Section 6.1.3, value difference between any two cultures is relative (Hofstede, 1997). In this way, aspects of any culture which are uniquely de-emphasised or not as emphasised as other cultures can become the defining features of that culture, rendering it unique in associated ways. These cultural differences in values and beliefs may be articulated in the form of different educational principles and beliefs, which in turn define the characteristics of national and/or sub-cultural (mathematics) educational curricula (Woodrow, 2001). The data collected and analysed through the conduct of this study revealed certain mathematics educational values associated with the Victorian mathematics curriculum, values which were apparently not more emphasised anywhere else. Specifically, these referred to the value differences related to *technology* (Sections 5.3.2.4, 5.7.2, 5.9.2, 5.10.2) and *numeracy* (Sections 5.5.2.1, 5.7.2, 5.8.2). Four of the eight teacher participants had reported how *technology* was valued more in the Victorian

classroom than in their respective home cultures. Also, amongst the teacher participants, the experiences of three of them demonstrated that the Victorian mathematics curriculum appeared to emphasise *numeracy* more than in their respective home cultures' curricula. Specifically, Manoj, Betty and Khaliq had expressed their views that the mathematics curriculum in Victoria emphasised more on *relevance* and *applications*, these being key ideas in the construct of numeracy (see Section 8.2.2). That none of the other teacher participants perceived Victoria as valuing these two aspects relatively less, then, suggests that *none* of the eight foreign cultures' school mathematics curricula valued *technology* and *numeracy* more than Victoria's Curriculum and Standards Framework. In this sense, these have defined two striking features of the Victorian secondary mathematics curriculum within the context of this research study.

8.2.1   Defining Feature 1: Technology

Four of the eight immigrant teachers had perceived a difference between their own home cultures and Victoria's valuing of *technology* with regards to the teaching and learning of school mathematics. Betty expressed concern at students' inappropriate use of computer and calculator technology, and she also felt that *technology* was often valued at the expense of the *beauty* inherent in mathematics. As for Carla, Li Kang and Saka, all three were of the opinion that there were signs of student over-reliance on *technology*, a phenomenon which could threaten the level of student competence in basic computational skills. In addition, Carla mentioned that calculator use amounted to a contradiction when the Curriculum and Standards Framework stated as one of the goals of school mathematics teaching, the acquisition of "mathematical skills and knowledge so they [the students] can deal confidently and competently with daily life" (Board of Studies Victoria, 2000, p. 6), since individuals normally lead daily lives (and solve emerging problems) without necessarily carrying calculators with them! Three of the teachers (Carla, Li Kang and Saka) were teaching in VCE classes of Further Mathematics, Specialist Mathematics and Mathematics Methods (respectively) at the time of this study, and the curriculum's emphasis on the use of the graphing calculator was arguably the strongest at these levels. Betty, on the other hand, was observed teaching in a Year 9 mathematics class. Although Betty's questionnaire response indicated that she also perceived the *technology* value difference at the other (VCE) levels she was teaching, the lesson and interview data suggested that the imperative for calculator use had filtered down the levels of school mathematics curriculum to the Year 9 level as well. Similar

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phenomena with other aspects of the mathematics curriculum have also been reported elsewhere (e.g. Brew, Tobias & Leigh-Lancaster, 2001; Clarke & Stephens, 1996).

Indeed, the Victoria Curriculum and Standards Framework's emphasis on the harnessing of educational technology in mathematics education is arguably a defining feature of the state's secondary mathematics education system. One of the Curriculum and Standards Framework's seven goals of school mathematics learning, as stated in Board of Studies Victoria (2000), is for students to "use technology appropriately and effectively to support the learning of mathematics, and in carrying out mathematical activities in context" (p. 6). Fulfilling these goals and working mathematically involve engaging students in activities that develop their "practical ability in ... making sensible use of calculators and computers" (p. 6). As such, a section of the CSF is devoted to a discussion called 'information and communications technology in the mathematics CSF' (pp. 8-9). A relationship between this emphasis on *technology* and the curriculum's more general values relating to mathematics education was established by Leigh-Lancaster (2000):

> A key reason for this ... position [to create technology-active, rather than technology-free or technology-neutral assessment] relates to values and beliefs about mathematics: mathematics at school should be like mathematics as used outside school. As mathematics outside school changes and the methods of choice change, so also should the methods of choice at school change, to the extent that this is reasonably possible. (p. 10)

which, in itself, may also be perceived as contradictory, in relation to Carla's view discussed in the opening paragraph of this section.

While many other nations may also be encouraging the integrating of calculators and mathematics learning/teaching computer software into teachers' pedagogical repertoire, a shift from school-based curriculum planning to a centrally-imposed curriculum framework in the mid-1990s (Clarke, Clarke & Sullivan, 1996), together with a pre-tertiary standardised, high-stakes examination system which has moved from being technology-free (Leigh-Lancaster, 2000) to technology-active in three years, had resulted in a prescribed curriculum which brings to centre stage the role of technology in mathematics learning and teaching. This latter factor is significant, in that it demonstrates how assessment (the attained curriculum) could be — and has been — structured to induce, or to inculcate changes in teacher practice (the implemented curriculum) as well (Lange, 1996).

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Although the use of scientific calculators has been permitted in examinations in Victoria since 1978, such assessment was considered technology-free. From 1997, approved graphing calculators can be used by students in the tertiary-entry mathematics examinations, but the papers remained technology-neutral, in the sense that the questions were not designed to disadvantage any student, whether she has access to a graphing calculator or not. This phase had been a short one, however, as examinations questions from 2000 onwards have been designed to be technology-active, with assumed student access to the technology, such that some questions are designed to require its use. The state education authority's valuing of *technology* in the mathematics curriculum continues, with the introduction of 'mathematics methods computer algebra system (CAS) pilot study' in 2001. By 2003, 19 secondary schools in Victoria, spanning across the different educational systems and different geographic locations, were involved in the project harnessing hand-held and computer-based CAS technology (Victorian Curriculum and Assessment Authority, 2003). The VCE papers for students in participating schools have also been modified to reflect an expectation of the students' capability to use this new technology in their mathematical work.

A survey of how *technology* is valued in some other mathematics educational systems may illustrate Victoria's uniqueness in this regard. As of 2003, emphases on the use of relevant computer software, graphing calculators and even CAS were evident to different degrees in the other states and territories of Australia (Leigh-Lancaster, personal communication, June 5, 2004). Although the Victorian VCE examinations had become technology-active in 2000, it is not until 2004 when "every state and territory [of Australia] has permitted [only] the use of handheld graphing technology in senior years and high-stakes external examinations (where applicable) for students of mathematics" (Arnold, 2004, p. 17). Although the International Baccalaureate mathematics examinations was technology-active (just like the VCE), the harnessing of CAS technology was only beginning to be considered in its 2003 review process. In other parts of the world, Denmark, France and Germany had been allowing students to make use of CAS calculators in their mathematics examinations, although it was not clear in all cases if the assessment questions were technology-active or technology-neutral (Victorian Curriculum and Assessment Authority, 2003). The Danish Bacclauréat Mathematics examinations may be technology-active, but some questions appeared to have non-CAS / CAS alternate versions (Evans, Norton, & Leigh-Lancaster, 2004). The USA College

Board's Advanced Placement Calculus examinations allowed student access to approved CAS calculators, but basic capabilities of graphing calculators "should provide the sufficient computational tools for successful development of a solution to any exam question that requires the use of a calculator. Care is taken to ensure that the exam questions do not favor students who use graphing calculators with more extensive built-in features" (College Board, 2003).

Thus, the valuing of *technology* in the Victorian mathematics education system has been unique in that it remained steps ahead of other comparable educational systems, as well as educational systems in the region, in harnessing new technologies, especially handheld technologies. Leigh-Lancaster (personal communication, June 5, 2004) summed up the position of the Victoria mathematics education system in the following way:

> In summary, Victoria is unique in that it is a 'mature' gc [graphics calculator] use system (with assumed access for all parts of all examinations) and its CAS pilot also assumes student access to approved CAS for all parts of all examinations.

In some ways, the extent to which Victoria's mathematics curriculum embraces *technology* may be reflected also in the internationally active agenda and output of related educational research in Australia in general, and Victoria in particular. For example, Arnold (2004) noted the high frequency of Australian research amongst 43 quality research studies on handheld graphing technology, selected by a research team based at Michigan State University from over 180 identified reviewed and published research reports based on strict "criteria related to publication, perceived relevance, inclusion of evidence, rigour and scientific design" (p. 17).

If the Victorian mathematics curriculum's proactive adoption of (handheld) technology has been guided by institutional vision of how school mathematics can remain relevant to emerging trends and lifestyles in the society, then the reason(s) for its relative success over other curriculum bodies outside Victoria in actualising this vision appears unclear. This is especially significant given that other states and territories of Australia have not been able to match Victoria in emphasising *technology* in school mathematics education. Could it possibly be due to the presence of a group of passionate and dedicated believers in *technology* within the mathematics education administrative level of this Australian state? Or could it be the availability of a critical mass of (mathematics) educational researchers in Victoria who has been responsible for engaging in related cutting-edge research, and for supporting technology use in local schools? There is also

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the question of the role played by the financial involvement of the major graphing calculator corporations, in the contemporary political climate of diminishing taxpayer-funded research in Australia. For example, 'Texas Instruments Australia' is based in Victoria. So was the influential 'computer algebra research project', conducted by the University of Melbourne in partnership with the Victorian Curriculum and Assessment Authority, and supported by Casio, Hewlett-Packard, and Texas Instruments. In a related manner, could the push for the adoption of handheld technologies be a manifestation of transferring the financial burden from taxpayer-funded acquisition to a user-pays system at the individual level?

8.2.2   Defining Feature 2: Numeracy

The second defining feature of Victoria's school mathematics curriculum as defined by this study's data is 'numeracy'. In its report, 'Numeracy = Everyone's Business' to Australia's Department of Employment, Education, Training and Youth Affairs, the Australian Association of Mathematics Teachers regarded the following as its description of 'numeracy': "to be numerate is to use mathematics effectively to meet the general demands of life at home, in paid work, and for participation in community and civic life" (Australian Association of Mathematics Teachers, 1997, p. 15). Johnston and Yasukawa (2001), in critically reflecting their co-construction of the meaning of numeracy, provided an useful analogy to the same effect,

> permitting, indeed requiring, it [numeracy] to be a bridge between mathematics and society. To be numerate was to negotiate the world — including its values — through mathematics; it was also to negotiate the mathematics that constructs the social realities we live in. Both sides of the bridge were core to this concept of numeracy, both the socially critical and the mathematical. In this sense, numeracy was larger than mathematics and unable to be confined within it or within any single level of it. (p. 291)

The term 'mathematical literacy' has been used elsewhere to refer to a similar concept (see Organisation for Economic Co-operation and Development, 2001, p. 14). A valuing of 'numeracy' would then have as its focus the teaching and learning of mathematics to equip learners with the necessary knowledge, skills and dispositions for life and career demands. In a way, then, numeracy relates to the cultural and practical, while mathematics as a discipline appears to be more abstract and theoretical.

The distinction of the Victorian mathematics curriculum as one which values *numeracy* first surfaced when the questionnaire data was being processed. Out of the 35 immigrant teachers responding to the questionnaire (some of whom subsequently were

part of the eight teachers who took part in the next phase of the study, involving lesson observations, interviews and document analyses), 17 (that is, nearly half of them) had written about differences between the mathematics curricula in Victoria and in their respective home cultures that suggested a greater emphasis on *numeracy* in Victoria. None of these teachers referred to the contrary. Terms used by the questionnaire respondents to describe how the Victorian mathematics curriculum differed from the home culture's equivalent included practical and applicational knowledge (versus rote learning, drills, pure mathematics), development of skills (versus mathematics for theory and knowledge), and activity-based learning (versus learning of concepts).

Amongst the eight teacher participants, three of them (Betty, Khaliq and Manoj) had expressed the view that the content of the school mathematics curriculum in Victoria was relatively more relevant and more likely to be related to real-life, authentic situations and problems than the mathematics curricula of their respective home cultures (i.e. British, Lebanese and (Fiji) Indian respectively). None of the other five immigrant teachers felt that the school mathematics curricula in their own home countries featured more real-life applications. The applications involved in mathematics learning/teaching that the teacher participants talked about extended beyond providing computation problems with contextual background, to situating such problems in authentic everyday contexts drawing upon mathematical skills and knowledge from multiple topics, where the solutions might not be nice whole numbers, or there might be multiple solutions as in open-ended questions. As observed by the three teachers, such authentic applicational questions were particularly suited to students' needs and helpful in their future studies or work.

How are these teachers' views reflected in the Curriculum and Standards Framework (CSF) (Board of Studies Victoria, 2000)? Amongst the document's expressed goals for school mathematics are student acquisition of "mathematical skills and knowledge so they can deal confidently and competently with daily life", and development of "knowledge and skills in using mathematics for employment, further study and interest" (p. 6). Thus, students are expected to "acquire numeracy skills that enable them to use mathematics sensibly and confidently in a variety of different situations" (p. 8). In this regard, successful approaches to mathematics teaching would be characterised by, amongst other factors, an emphasis on applications (p. 9). This reflected the vision of the national mathematics curriculum profile (Curriculum Corporation, 1994) in different

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ways. One, the CSF reflected a continuing emphasis of 'mathematics for all' and its relevance to the needs of day-to-day living. Also, there was the aim by the national framework to be proactive to economic needs and thus the preparation of students for future employment. A successful learning of numeracy concepts and skills by students is expected to cultivate lifeskills and dispositions that would become increasingly important in the emerging economy. These lifeskills and dispositions might include creativity, the flexible harnessing of technology, and the embracing of change; arguably, a contextually-based numeracy education has greater promise in delivering these qualities than a theoretically-based mathematics education. Thus, as Horwood and Thomas (2000) noted in their review of Australasian mathematics education research conducted in the second half of the 1990s, "major changes to educational policies and operations have been introduced in order to align the goals of education to the perceived needs of business and industry" (p. 351). It is thus by no coincidence that Victoria's Curriculum and Standards Framework was highlighted for discussion in Lange's (1996, section 5.4) review of applications oriented mathematics curricula around the world, and that its focus on numeracy was regarded as a characteristic feature by the immigrant teachers of secondary mathematics.

8.3 Values Education in Mathematics Education

Through inquiring into the professional socialisation experience of immigrant teachers in Victoria, this study has highlighted how the secondary mathematics classroom can be as values-rich as any other classroom in the school, and how these teachers functioned in this environment through engaging in valuing processes with their own value schemas. The values-rich nature of the mathematics classroom is a reflection that although mathematics may be perceived by the immigrant teachers as being pan-cultural in nature (thus, a school subject sharing similar values across cultures), research evidence here indicates that different culturally-based values regulate how the same pan-cultural mathematics may be taught differently, contribute to different educational aims and objectives, as well as affect the nature of the relationship between the educational institution and the mathematics teachers' practice in the classroom, all in different ways.

Thus, if education is essentially about inculcating desirable values in the students, then the presence of mathematics educational, general educational and organisational value differences mean that different values may potentially be taught through, and in,

school mathematics. In addition, the socio-cultural nature of mathematics and school mathematics implies that even if mathematics is seen to be pan-cultural, there exist certain values associated with the discipline which may be espoused in the mathematics classroom. Yet, it is fair to say that the subject of mathematics is very seldom associated with values teaching, unlike science (e.g. ethical issues related to cloning), history (e.g. moral justifications for particular battles), SOSE (e.g. conservation of nature), or language (e.g. theme-based, whole-language teaching approach). A greater awareness amongst policy makers, educational administrators, and classroom teachers is clearly required to actualise a total educational experience that explores and teaches values in consistent ways in all school subjects, including mathematics which is often a compulsory subject in many education systems around the world.

What is the immediate significance of these? The ongoing Victorian Curriculum Reform in 2004 has identified as one of three pillars supporting the new framework of 'essential learning',

> personal and social development ... [as a] core business for education. This involves development of specific forms of knowledge and skills together with values and personal attributes. (Victorian Curriculum and Assessment Authority, 2004, p. 4)

There is an emphasis for the new curriculum framework to recognise *both* — and distinguish between — the enabling skills and knowledge on the one hand, and values and attributes on the other. After all, students

> need access to core understandings about how to function effectively[. While] much of this will derive from the core discipline concepts and generic skills ... some will be specific knowledge and understanding of our society and culture. (VCAA, 2004, p. 4)

To this end, the VCAA has adopted the set of ten commonly-fostered values identified in schools around Australia through the 'Values Education Study' (Curriculum Corporation, 2003) as a "starting point for the elaboration of a statement of values" (VCAA, 2004, p. 4). The 'Values Education Study' had earlier found out that "these values are shared with remarkable consistency across the broad range of schools represented in the project, including very disadvantaged schools and the more advantaged schools" (Curriculum Corporation, 2003, p. 157). Specifically, these values are:

tolerance and understanding

respect

responsibility

social justice

excellence

care

inclusion and trust

honesty

freedom

being ethical

In this public consultation phase of the curriculum reform, the following two related questions were posed:

the framework should be underpinned by an explicit statement of broadly agreed values. Do you agree?
what comments do you have about the set of values provided ...? (VCAA, 2004, p. 5)

In addition, a set of generic skills, values and attributes has also been defined by the Victorian Curriculum and Assessment Authority, covering the social/cultural and organisational/employability aspects of education (Victorian Curriculum and Assessment Authority, 2004). The expectation is for schools "to incorporate an agreed set of skills and values across the curriculum and develop methods for assessing them as appropriate" (p. 8). The emphasis, thus, is for the fostering of values through the different school subjects. Unfortunately, the phrase 'as appropriate' seems to convey a contradictory message somewhat, as it signals a sense of option and choice in relation to values assessment and/or teaching.

At the national level, the aforementioned 'Values Education Study' commissioned by Australia's Department of Education, Science and Training (Curriculum Corporation, 2003) appears to be more affirming — but not directly so — of the role that mathematics teaching in schools may potentially play in a values-based education. Amongst the three different domains of values education identified, the underpinning vision for improved values education acknowledges the incorporating of values into the curricula of key learning areas, which includes mathematics. In particular, quality teaching encompasses the notion that "schools and educational leaders recognise that values interact with and

are integral to all key learning areas" (Curriculum Corporation, 2003, p. 152), a point which is not lost in the Victorian curriculum reform exercise.

The listing of the set of ten shared values to be fostered through school education is accompanied by examples of curriculum programs and classroom activities appropriate to each of the values. An example of this is the possibility of inculcating *respect* through "team-based approaches to learning, problem solving and the completion of tasks" (p. 158). Clearly, while these recommendations may not be subject-specific, they have the potential to assist teachers of secondary mathematics — both immigrant and 'native' — to be more aware of the value-laden aspect of parts of their professional practice.

Nevertheless, the report also noted that the 'how' of incorporating values into the school subjects had been a challenge facing case study schools. To this end, 'Recommendation 7' of the report states

> that the Commonwealth, in collaboration with education jurisdictions and schools cooperate in providing teachers with resources (including professional development, teaching resources and evaluation materials) to support their efficacy as teachers of values within all areas of the curriculum and total school life and to monitor this efficacy on an ongoing basis. (p. 164)

The state and national discussion of values teaching in education has also recently become part of the ongoing political debates relating to the divide between public and private education systems (e.g. Green & Tomazin, 2004; Maiden, 2004). Earlier in 2004, the Australian Prime Minister had controversially claimed that the increase in student enrolment in non-government schools throughout Australia was a reflection of a lack of emphasis in values cultivation in the public school system. A study conducted by the Australian Council for Educational Research with 600 parents with secondary school-going children had revealed that a *perception* that non-government schools are more likely to embrace traditional values has emerged as a very significant factor guiding parental choice amongst the school systems (Green & Tomazin, 2004).

Although this research study is not specifically focussed on values education, or on student enrolment in particular school systems, the unique socialisation experiences of the immigrant teachers of secondary mathematics have put in relief the value-ladenness of school mathematics teaching and learning. In particular, this research study reveals that values are already being espoused, contested and affirmed in the mathematics teaching and learning environment, whether this is located in public (government) or private (non-government) settings. Appropriate and creative professional support for classroom

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teachers of (secondary) mathematics is likely to be not only important —— but also timely — in facilitating Victoria's ongoing curriculum reform in ways which incorporate more seamlessly the recommendations of the 'Values Education Study', as well as in helping to address societal mis-conceptions regarding the relative lack of values education in public schools.

To better achieve this, it is perhaps instructive to focus on the observation in this study of the valuing that the teacher participants were engaging in. The negotiation of perceived value differences involves more than acknowledging the presence of values operating in the socio-cultural environment within which the mathematics classroom is situated. The process reflects the teachers' consideration of, comparing amongst, and contesting the various values. Indeed, it is an embodiment of the teachers' *valuing* of aspects of mathematics, education, and mathematics education. Thus, a step further forward is to move beyond the identification of values, to a recognition of valuing. The findings of this study has in this sense positioned us at a good vantage point, with its discussion of how valuing is enacted through a range of approaches to mediate value differences in the context of the personal value schema.

8.4 Beyond Celebration of Diversity and Difference

Shifting our focus back to the professional socialisation of immigrant teachers of mathematics, it can be very tempting to conclude from the findings discussed that this group of practitioners has succeeded professionally because they were able to adopt a range of responsive approaches to perceived value differences in the secondary mathematics classroom. In negotiating perceived value differences in their workplaces, it appears that immigrant teachers can either choose to embrace values reflective of their respective home cultures or of the Australian culture, or to integrate the different cultural values in productive ways. The broad findings, thus, have the potential to draw one into joining a chorus of support, affirmation and celebration of diversity and difference in the society in general, and in Victorian (mathematics) education in particular.

However, while this can be very positive and encouraging towards considerations for inducting immigrant teachers, and indeed, any teacher in transition (understood broadly), how useful and potentially empowering would the findings be for any immigrant teacher of secondary mathematics from the professional development perspective? How would it help these teachers if they are simply presented with a range of responsive approaches

with which they may negotiate future perceived value differences? Does the list of responsive approaches (Table 6.1) imply that any one approach may be used to help the immigrant teacher make sense of a particular perceived value difference? If not, how would the immigrant teacher make an informed choice as to which would be the most appropriate or helpful response? What would the implications be of the observations in this research study that each of the eight immigrant teacher participants had adopted multiple approaches in their respective negotiation of perceived value differences?

The data of this study have not been interpreted with the expressed aim of celebrating diversity and affirming difference. Rather, the discussion of the immigrant teachers' responsive approaches in relation to the contextual factors operating within the workplace environment has highlighted the complexities and limitations of each type of responsive approach identified. In this way, the data interpretation exercise adopted for this study has echoed Lubienski's (2003) concern:

> What I am calling for here is a critical examination of what might be lost amid the current climate that conveys that diversity should *only* be viewed in a positive light .... I am raising questions about whether restricting our discussions to only positive aspects of diversity is an academic, middle-class luxury that detracts attention from research on social class and larger, systemic inequities. (p. 36)

The value of looking beyond these celebrated aspects of diversity and difference is also a point raised by Barry McGaw, the Director of the Directorate for Education in the Organisation for Economic Co-operation and Development (OECD), in a recent keynote address in an international mathematics education research conference. In relation to Australia's performance in the international comparative study, PISA 2003, McGaw (2004) concluded his speech by warning that

> it [Australia] seems at best to have celebrated its high average without looking further at the hard questions [relating to inequity in the provision of mathematics education]. (p. 44)

Thus, a way of looking at the 'hard questions' has stemmed from conceptualising this thesis within a socio-cultural framework, with the data analysis and interpretation acknowledging that the immigrant teachers' professional socialisation experiences were not a reflection of how they functioned in — and responded to — an environment which was static and fixed. Otherwise, any immigrant teacher's response to particular perceived value difference could be easily used as a case study for other (immigrant) teachers to learn from. That this research study recognises that any two immigrant teachers can possibly respond to the same perceived value difference successfully, but with different

approaches, also acknowledges the interactional co-construction of realities by *both* the immigrant teacher and the socio-cultural environment within which she practises, one which is 'alive' and responsive.

Instead of adopting a deficit view and claiming that particular values may be too exotic or unsuitable in the context of mathematics teaching and learning in a classroom in Victoria, this research study has recognised particular values (both home culture values and values associated with the Australian culture) as being the products of cultural sense-making by the immigrant professionals. In exploring the complexities and limitations involved in the negotiation of perceived value difference, in examining the range of operating contextual factors which provided both affordances and constraints, empowering future immigrant teachers is regarded as not merely knowing the range of possible approaches towards negotiation and mediation, but also encompasses an understanding of the challenges involved in this negotiation process.

Thus, from the practical, professional development angle, the findings of this research study should not be interpreted as providing immigrant teachers of secondary mathematics with the 'how' of negotiating perceived value differences, but rather, the 'how' of better interpreting such situations, on which appropriate and sound decisions may be made.

8.5 Critique of the Study

As is the case with all (educational) research, one makes the best decisions with regards to research methodology and to data interpretation one can within the parameters of limitations posed by physical and ideological constraints. Before embarking on a discussion of the theoretical and practical implications arising from this study, it is important to acknowledge the limitations inherent in this study, so that these implications may be understood in the context of these constraints.

Firstly, the findings of this study should be interpreted in the light of the knowledge that the immigrant teacher participants were chosen based on criterion-based selection, rather than being chosen randomly (see Section 3.2). With the limited number of potential immigrant teacher participants available, the eight teacher participants were so selected to represent a spread across educational systems, geographical location, gender, years of teaching experience, and broad cultural categories according to the inhabited continents

of the world. While this distribution allowed us to learn about the socialisation experience of a 'balanced' representation of the body of immigrant teachers in Victoria, it is inevitable that in so doing, other possible ways of representation have been de-emphasised. For example, one other way of selecting the teacher participants might have been to achieve a balanced ethnic representation based on the relative cultural proportion of the immigrant teacher population in Victoria, in which case the data presented in Appendix 14 would be instructive. Alternatively, since this research study emphasises the interaction between values and mathematics pedagogy, one may also argue that a greater proportion of Asian or religious immigrant teachers would be desirable in the sam *. since the role of values teaching in (mathematics) education is often more explicitly expressed in the curricula of many Asian nations, and through the teachings in various religions.

Another point of criticism is that data from each of the teacher participants had been collected with the same instruments, and these were analysed in a uniform manner as described in Chapter 3. While this may be considered desirable from the perspective of contemporary research methodology, a consideration might be that this is relevant insofar that the sample from which the data has been collected is homogenous. But cultural homogeneity can be a 'slippery' notion, especially if 'culture' is understood broadly. One possible limitation in the context of this research study is the different ways in which Asian immigrant teachers and their Western colleagues respond to questionnaires and interview questions. For example, Cao (2004) noted the culturally different ways in which Chinese and Australian respondents interpreted the middle option (i.e. 'neutral') of a five-point Likert scale. Thus, this has to be kept in mind in our understanding of the context of this study, provided through the immigrant teachers' responses to the questionnaire used in this study, and reported in Chapter 4.

A degree of cultural sensitivity had also been exercised in the conduct of the interviews. While the interview protocol (Appendix 11) might have provided a general structure to the semi-structured interview sessions, the phrasing of similar question items was not verbalised in the same grammatical structure. Generally, when interviewing more traditional Asian immigrant teachers like Li Kang and Manoj, more context was built into the vocalisation of interview questions to make these appear less abrupt and up-front. Nevertheless, it is worth noting in this section how immigrant teachers from different cultures may interpret similar questions differently in terms of not just vocabulary but

also in terms of overall tone, with the assumption that this affects the amount and depth of response rendered by the immigrant teachers. After all, my ethnicity might only help me to be more sensitive to the cultural characteristics of Asian teacher participants, and in the relative dearth of academic literature on this aspect of the interaction between culture and methodology, it is only reasonable to suppose that the cultural sensitiveness of the Middle Eastern or East European immigrant teachers might have been overlooked.

The issue of vocabulary was raised in the last paragraph, which implies that the differential command of the English vocabulary amongst immigrant teachers from different cultures might have impacted on their understanding and interpretation of the questionnaire and interview items. Although such misunderstandings might have been minimised somewhat in this study through the inclusion of interview items to cross-check responses and the employment of different data-collection methods to triangulate data, a real challenge to a fuller understanding in the researching of values in the context of mathematics education is "the lack of an appropriate and shared vocabulary to discuss the types of values ... based in mathematics and mathematics education" (Clarkson, Bishop, Seah, & FitzSimons, 2000; see also Chin & Lin, 2000b; Clarkson, Bishop, FitzSimons, & Seah, 2000). Notwithstanding the fact that the very concept of 'values' is not easy to define (see Section 2.2.2), it has also not been easy to make use of the English language to adequately describe the intensities and range of values, value differences and value negotiation. Thus, another inevitable limitation of this research study is the relationships between the quality of responses from the immigrant teacher participants, and the quality of description and interpretation of these responses in this reporting of the research study.

Certainly, one main reason for this relative lack of a vocabulary with which values are discussed may be the very private nature of individuals' personal values (see Sections 3.1 and 3.3.4). That values are more internalised than beliefs and attitudes (Section 2.2.2) contributes to an understanding of this aspect of values. In this light, the incorporation of the 'recursive probing approach' in the interview protocol of this study (see Section 3.3.4) was intended to maximise the quality of the immigrant teachers' feedback and sharing (see Appendix 11 for a demonstration of how this was incorporated into the interview protocol). Nevertheless, it is also reasonable to propose that individuals from different cultures may feel more or less comfortable to talk about their own private values. It is also arguable that researcher personality and ethnicity can affect the degree to which research participants reveal their own personal values. In other words, the private nature

of values, cultural differences, and quality of researcher-participant relationship can all interact to affect the validity of the data collected through discussions of values in this — and related — research studies. In this light, the short description of teacher participant characteristics and of the (emerging) researcher-teacher participant relationship that accompanied each teacher participant's results (e.g. Sections 5.3.1.1 and 5.4.1.1) were included to help the reader better interpret the presented results in context.

The qualitative nature of this research study provides another limitation which, while inevitable, needs to be taken into account as the reader reads through the chapters. As discussed in Section 3.1, the qualitative research approach is particularly appropriate, considering the nature of this research study. In that section was discussed how this research has been set up to describe and understand processes and sequences, with a recognition that there is no single reality within which these may be interpreted. The conceptual and practical preference for the qualitative methodology in researching such constructs as values, beliefs and attitudes was also presented in Section 3.1. In emphasising the richness and depth of our understanding of cases, however, the qualitative research tradition does not provide for a representative breadth across the population. In other words, as in other qualitative research, an inherit tradeoff is a lack of generality of the findings. It is therefore not possible to extend the findings, and conclusions to all immigrant teachers of secondary mathematics in Victoria, and neither is it possible to construct generalised statements about the professional socialisation experiences of immigrant teachers from particular home cultures or of particular amount of teaching experience in Victoria. Of course, arguably, generality is also a criticism of quantitative research methodology, if the unique social-cultural context of each individual is acknowledged to underlie the way her life experiences evolve.

Last but not least, I am value-laden myself as an individual. My personal values relating to mathematics, to mathematics pedagogy, and to education are expected to have impacted on what constituted 'data', and how these were subsequently interpreted. The adoption of multiple data sources to achieve 'triangulation' has been an attempt to minimise the potential threat from this source to validity in the research findings. The deployment of only one (instead of several) researcher also ensured a certain degree of consistency in data validity. Yet, it is useful to make sense of the findings and conclusions presented in this chapter — as well as in Chapters 6 and 7 — keeping this

and the other limitations outlined above in mind. In other words, an understanding of the findings and conclusions in the light of these inevitable limitations (given the inherent constraints) is possibly the most valid and most reliable way for us to inquire into the lives of immigrant teachers in Victoria as they negotiated perceived value differences in the secondary mathematics classroom.

The conception of this research study had been motivated by the identification of a problem confronting immigrant teachers of secondary mathematics in schools in Victoria (see Section 1.4). The findings and conclusions were derived from the conduct of a qualitative educational research built upon a theoretical framework that was defined in Chapter 2. The conclusions and implications discussed thus far have likewise addressed both theoretical and practical ideas. This study will now close with the next two sections which attempt to identify the steps forward for both research and practice. First, in Section 8.6, suggestions for ways of furthering academic understanding of relevant theories through further research will be discussed. Next, Section 8.7 will identify some of the practical implications arising from this study which might relate to the optimisation of the teaching and learning of school mathematics. In this way, the two sections hope to extend available possibilities in which educational research may contribute to professional practice in the classroom *both* directly and indirectly, thereby addressing the concerns and issues discussed in the opening chapter of this research study.

8.6 Implications for Further Research

From the theoretical perspective, this study has opened up avenues for further research opportunities and explorations. For example, that it has documented the negotiation of perceived value differences by immigrant teachers of secondary mathematics might have provided us with more knowledge and a better understanding of how such potential sources of dissonance may be mediated, but this has also raised questions of how these value differences may not be as successfully negotiated by other immigrant teachers. Related data may be collected in further research from immigrant teachers who had left the teaching service in Victoria. With these (ex-)teachers may be explored the nature of contextual factors that rendered particular responsive approaches as listed in Table 6.1 to be relatively ineffective. Useful knowledge may also be constructed from an inquiry into unique, new responsive approaches which might have been adopted by this group of immigrant teachers who had left the teaching service. To

what extent did these approaches or responses possibly contribute to the teachers' departure from their careers? In fact, was the departure attributable to any particular perceived value difference, or to any value difference which might even not have become apparent to the individual teacher until it proved too overwhelming to be negotiated with any degree of success? What might be some of the unique contextual factors which were likely to have acted as barriers or constraints for these teachers in general?

The quantitative display of the results of the schools and teachers' survey reported in Chapter 4 implies that several aspects of the immigrant teacher deployment/distribution across the state and within schools deserve further research attention, and contributing factors addressed. For example, how can the regional cities attract more immigrant teachers of mathematics (see Table 4.5)? Also, is the observation that immigrant mathematics teachers from the Middle East were not teaching the relatively 'harder' subjects of Mathematics Methods and Specialist Mathematics, and that colleagues from America were not involved in teaching General / Further Mathematics (see Figure 4.8), at the VCE levels indicative of any cultural assumption and bias?

The notion of the personal value schema was discussed in Sections 7.1 and 7.2. The mapping of the values which constitute the different levels within such a schema, as well as the effect on this structure brought about by value change, have not been able to be established with sufficient specificity in this study. As such information had not been an aim of the conduct of this research study, the methodology of this study was not structured to provide the much-needed opportunities for sustained, long-term collection of data. One can envisage a longitudinal research design which incorporates more lesson observations, more interviews, and more content analyses which would provide the scope for more reports of perceived value differences. In turn, a richer picture of the personal value schema of individual teacher participants (see, for example, Section 7.1), as well as more evidence of how competing, overriding and second-hand values may be internally re-organised in the context of value change (see, for examples, Sections 6.2.1.4 and 6.3.5), can possibly be gained from conducting such complementary research. While the current study is an inquiry into the negotiation of value differences from the perspective of personal value schemas, the longitudinal research design mentioned above would be a study of the structure and functioning of the personal value schemas through looking at how value differences are negotiated by individuals.

The relative dearth of educational research on values in mathematics pedagogy was highlighted in the review by Bishop et al. (2003), and supported by what was included in the discussion in Section 2.2.5. This is in contrast to the higher amount of mathematics educational research activities relating to beliefs and attitudes. Could the availability of user-friendly, validated and reliable instruments (e.g. the Fennema-Sherman Mathematics Attitude Scales, Schoenfeld's Mathematical Beliefs questionnaire; see also, Malmivuori, 2001, Chapter 2) with which to gather data on beliefs and attitudes be a possible explanation for the relative popularity of mathematics beliefs and attitudes research? Viewed another way, would mathematics education research have acquired a deeper understanding of values and mathematics teaching / learning if there had been a culturally-validated measuring tool available with which values related to mathematics education may be surveyed and explored? There is no evidence that such an instrument exists for teachers or students of school mathematics, although the various research projects investigating values in the mathematics education context (see Section 2.2.5) have constructed and validated their own values surveys and questionnaires. Clearly, there exists a need for the mathematics educational research community to facilitate the compilation of values survey instruments that are designed to identify specific values relating to mathematics and its pedagogy. Indeed, the availability of such a data-collection instrument could potentially inspire more mathematics educational research focussing on values.

It was explored in Section 7.4 how an immigrant teacher's teaching experience in the host culture might possibly correlate with a fostering of *cultural relativism*. While this current study and its research design were not meant to provide answers to the nature or strength of this relationship, it can be of academic significance to be able to shed further light on this aspect of teacher professional socialisation. For example, to the extent that *cultural relativism* mediates an individual's interpretation of perceived value differences, there may be implications for proactive and purposeful inculcation of this value in immigrant teachers, and indeed, all teachers in transition, such that it emphasises to these professionals the possibility and usefulness of alternative interpretations of particular phenomena, each of which is contextualised within different cultures' unique ways of knowing, understanding and responding. Thus, a suggestion for future research in this regard may be to investigate the nature of fostering the valuing of *cultural relativism* within the immigrant teacher, and possibly, any teacher in transition, with the assumption

that this value is likely to empower such teachers to respond to perceived differences in values in positive and constructive ways. Possible research questions might include: to what extent is the fostering of *cultural relativism* a natural by-product of immersion in the host culture? How might the status of the home culture relative to the host culture play a part in this development? What are some of the contextual factors that might facilitate or constrain the development of *cultural relativism*?

8.7 Implications for Practice

Through this study, the professional voices of some immigrant teachers of secondary mathematics in Victoria have been presented and acknowledged. The report for this study began with a quote on the difficulties associated with 'culture switching', and by making explicit the complexities and limitations related to the decision-making processes involved in such an exercise of professional socialisation, this study has uncovered several avenues through which professional support may be rendered more effectively.

Victoria, like many other places in and beyond Australia, will witness an increasing number of immigrant teachers of mathematics in her educational system in the years to come. This is an inevitable phenomenon that is being witnessed both domestically (e.g. looming teacher shortage, see Section 1.2) and externally (e.g. demographic movements across geo-political borders brought about by globalisation, see Section 1.1). A more meaningful institutional response to the immigrant teachers' perception of difference and feeling of dissonance should thus be one that aims to smooth the transition experiences of these professionals. Any professional induction or professional development program which desires to fulfil this aim should preferably steer away from expecting immigrant teachers to become enculturated into the Australian values, not least because the very notion of what constitutes 'Australian' values is in itself multicultural in nature, and contextual in practice. On the other hand, the implication is also not about listing ways of preserving the home culture values of immigrant teachers. The ongoing evolution of an individual's personal value schema (Section 7.2) has meant that this discussion, in my concurrence with Groenfeldt's (2003) view,

> is less to *forecast* the future of indigenous values, than to suggest what responses we might take to influence that future — to create a world that has room for other ways of seeing, thinking, and 'valuing' …. [The] approach [of salvaging home culture values per se] would preserve information about *indigenous* values, but not the values themselves. Values are expressed by individuals living within a social group, having a shared culture … and depend on a cultural 'habitat' — a social

group — for their preservation. The preservation of values depends on the preservation of cultural identity within which indigenous values can be maintained. (p. 918)

As we have seen in Chapters 5, 6 and 7, this maintenance of immigrant teachers' professional confidence and cultural identity, and the preservation of culturally-appropriate home culture values which it entails, often also involves varying degrees to which these interact with values aligned with the Australian mathematics pedagogical and general educational traditions.

This calls for explicit immigrant teacher awareness of what can be professionally and personally negotiated, and a main recommendation from this study is for future immigrant teachers (of secondary mathematics) in Victoria to participate in more formalised induction courses. Such a provision should extend beyond introducing these newly-arrived teachers to the array of responsive approaches to perceived value differences (see Table 6.1 or 8.1), to facilitate knowledge, personal exploration and group discussions of the complexities and difficulties that may accompany attempts to make sense of and negotiate these situations. Such an in-service program also offers the newly-arrived professionals the invaluable opportunities to share personal experiences and stories relating to socialising into the local mathematics education system with fellow immigrants as these experiences and stories unfold.

The potential for this research study to demonstrate the complementary nature between affect and cognition was introduced in Section 1.7. It is perhaps significant that as a construct, 'values' has been defined in this study (see Section 2.2.5) as being both affective and cognitive in nature. It is rather clear from the data collected that the immigrant teacher participants' ability to negotiate value differences has strengthened their beliefs in their own capability to practise, their attitudes and confidence towards continuing to teach mathematics in Victoria, their ability to make meaning of perceived value differences, and their skills in responding to these potential dissonances in ways which empower them. That is, not only was the negotiation of perceived value differences both an affective and cognitive exercise in itself, the process also affects the individual's states of affect and cognition. Thus, there is perhaps a greater need to more consciously plan for professional development programs from the values perspective. More workshops aiming to facilitate or effect teacher change may well be planned with the approach of fostering teacher examination and fine-tuning of personal value schemas.

Value differences are of course discerned by all teachers (of mathematics) functioning in different cultural settings. There is no reason why such experiences may not also be encountered by teachers involved in other kinds of transition, as outlined in Section 1.6. The list of responsive approaches shown in Table 6.1 (or 8.1) can easily be adapted to assist teachers negotiate value differences inherent between government and non-government schools, single-sex and co-educational schools, VCE mathematics teaching and teaching mathematics in the middle years, for examples.

In particular, the world order has changed dramatically during the time this research study was conducted. The role played by an individual's cultural intelligence (CQ) in complementing her intelligence quotient (IQ) and emotional intelligence (EQ) can only become increasingly crucial. The findings of this study – in particular, an understanding of how some immigrant teachers of secondary mathematics in Victoria had negotiated about perceived value differences – can empower teachers in transition to function and excel in different cultures, thus nurturing higher cultural intelligence. The incident of September 11 and the ensuing events could have increased the pressure upon teachers in transition to more effectively reconcile their pedagogical practices in relation to their religious values and to the values expected of them by the institution. Certainly, the intensity of such a pressure differs amongst the different religions. An example of a teacher negotiating between her Buddhist religious values with the classroom values was reported by Chin, Leu and Lin (2001). Sensitive though this may be, ongoing professional support is nevertheless crucial to more proactively empower all teachers to locate an optimal position between their religious values and the institutional or social values embraced by the school within which they teach.

As discussed in Section 8.3, Victoria is undergoing a reform exercise of her school curriculum. It was also highlighted that although values education appears to assume a prominent position in this exercise, specific details of how the ten identified values may be efficiently and effectively cultivated in the young are relatively lacking. The experiences of the eight immigrant teachers as reported in this study affirm how teachers' own values were reflected implicitly through their classroom decisions and actions, and how these were expected to be inculcated in the students. Clearly, then, this study provides support to the notion that values teaching can be as effective — if not more so — when carried out implicitly (versus the more explicit 'values education' lessons

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planned for in school timetables). The study also lends further support for the discomfort associated with the use of the phrase 'values-based education' in official documents (e.g. Australian Department of Education, Science and Training, 2003, p. 149), for such usage appears to fail to acknowledge that all forms of education are by nature values-based. Even if the immigrant teacher participants were not delivering a 'values-based education', their individual professional practice was shown to be equally values-rich in nature. Thus, there is clearly a need for all stakeholders in education to view (mathematics) education in this light; that is, values education is not an add-on feature, but has always been part of what education in general — including mathematics education — provides.

With the above discussion, this chapter brings about a closure to the current study, the conception of which (as discussed in Chapter 1) was a concern for the affective and professional well-being of immigrant teachers of mathematics in Victoria, sometimes appearing invisible in the teaching service, and teaching a subject which is itself often considered culture- and value-neutral. It was envisaged that the multiple daily crossings of cultural frontiers in their professional practice in the cultural borderlands (Allan, 2002) would lead to dissonance. With a focus on the socio-cultural context of mathematics and mathematics education, on the values related to mathematics and mathematics education, and on teacher socialisation, Chapter 2 set up the theoretical and research framework, at the same time identifying the research questions which arose from the survey of available relevant literature. This informed the research design, which was formulated through the discussion developed in Chapter 3. A state-wide survey of the state of the immigrant mathematics teacher workforce first provided the background for this study. This was developed both through a postal survey returned by 159 school heads of mathematics departments, as well as a questionnaire survey of 35 immigrant teachers of secondary mathematics. The relevant information was presented in Chapter 4.

This background assisted in the subsequent development of more detailed research inquiry with eight selected immigrant teachers of secondary mathematics, involving lesson observations, interviews, and content analyses of student work. Chapter 5 reported on the data collected, presented in the order of individual teachers. In the next chapter (Chapter 6), these results were interpreted along a different dimension, cutting across the immigrant teachers, and focussing on the nature of perceived value differences reported, the teachers' responses to these incidents, as well as the examination of the contextual factors underpinning the teacher responses. As these discussions developed over the

chapters, it was also evident that the research questions formulated for the research study were being addressed. In addition, theoretical ideas were emerging from these discussions, and although these might not be directly relevant towards responding to the research questions, it was argued that a better understanding of these developed through Chapter 7 would also contribute towards the advancement of academic knowledge in general, and indirectly towards the understanding of the contextual complexities relating to the research questions in particular.

This chapter (Chapter 8) has been more practical in its approach, with the intention of providing a closure to the research study by relating to the more practical concerns and themes identified in the opening chapter. The unique features of the mathematics curriculum in Victoria have been identified through two of its prominent values that surfaced through this study, and the research has also highlighted the extent to which mathematics education lends itself to effective values education. Both these issues have direct implications for the state and the future of mathematics education in schools in Victoria. Having presented this study in the form of a research (learning) journey, the latest, ongoing curriculum reform exercise taking place in Victoria highlighting the fostering of desirable values was also discussed here in the light of the research findings and conclusions. The danger of succumbing to the seduction of celebrating cultural difference and diversity in research effort per se was also emphasised. A critique of the study followed, highlighting inherent limitations in the research design and socio-cultural context against which the research findings and conclusions should be interpreted and understood. Last but not least, the chapter has also pointed to some of the possible ways forward for changes in mathematics education in Victoria, as well as for future research in mathematics education, in professional socialisation, and in cultural studies.

Rogoff (1995) conceptualised three planes on which socio-cultural activities may be discussed, namely, personal, interpersonal (interactional), and community (social). Inquiring into the professional socialisation experiences of immigrant teachers of secondary mathematics in Victoria in this study has allowed for mathematics teaching to be examined on all three planes. Including the social plane in both the research design and the data analysis have helped to account for how changes in the socio-cultural professional environment influence (re-)constructions of what it means to teach and learn mathematics, and thus how the social plane impacts on the personal and interpersonal planes. Thus, overall, the preceding pages have shared with the readers a research journey

that not only demonstrated how an identified issue in mathematics education may be addressed satisfactorily from the socio-cultural perspective, but which has also exposed important complexities and difficulties, thereby opening new frontiers for creative research and practice to further fine-tune our collective capability in optimising school mathematics teaching and learning.

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APPENDIX 1

APPROVAL TO CONDUCT RESEARCH, MONASH UNIVERSITY STANDING COMMITTEE ON ETHICS IN RESEARCH INVOLVING HUMANS

3 July 2000

RESEARCH GRANTS AND ETHICS BRANCH

Prof. Alan J. Bishop
Education
Clayton Campus

Wee Tiong Seah
Faculty of Education
Clayton Campus

Re: Project 2000/240 - The negotiation and portrayal of values by migrant/foreign mathematics teachers

Thank you for the information provided in relation to the above project which was approved by the Standing Committee on Ethics in Research Involving Humans subject to the provision of further information.

The items requiring attention have been resolved to the satisfaction of the Committee. Accordingly this research is approved to proceed subject to the following provisos:

- Explanatory statement to be on Monash University letterhead
- Approval by school principals as required in letters from the Catholic Education Office

The project is approved as submitted for a three year period and this approval is only valid whilst you hold a position at Monash University. You should notify the Committee immediately of any serious or unexpected adverse effects on participants or unforeseen events that might affect continued ethical acceptability of the project. Changes to the existing protocol require the submission and approval of an amendment. Substantial variations may require a new application. Please quote the project number above in any further correspondence and include it in the complaints clause:

Should you have any complaint concerning the manner in which this research (project number.........) is conducted, please do not hesitate to contact The Standing Committee on Ethics in Research Involving Humans at the following address:

> *The Secretary*
> *The Standing Committee on Ethics in Research Involving Humans*
> *PO Box No 3A*
> *Monash University*
> *Victoria 3800*
> *Telephone (03) 9905 2052 Fax (03) 9905 1420*
> *Email:* ▉▉▉▉▉▉▉▉▉▉▉

Continued approval of this project is dependent on the submission of annual progress reports and a termination report. Please ensure that the Committee is provided with a report annually, at the conclusion of the project and if the project is discontinued before the expected date of completion. The report form is available at http://www.monash.edu.au/resgrant/h_a_ethics/human_ethics.

The Chief Investigators of approved projects are responsible for the storage and retention of original data pertaining to a project for a minimum period of five years. You are requested to comply with this requirement.

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Ann Michael
Human Ethics Officer
Standing Committee on Ethics in Research Involving Humans

APPENDIX 2

APPROVAL TO CONDUCT RESEARCH, VICTORIA DEPARTMENT OF EDUCATION, EMPLOYMENT AND TRAINING

Department of
Education, Employment and Training

Office of Schools

SOS001539

15 June 2000

Mr Wee Tiong Seah
Faculty of Education
PO Box 6
Monash University
Victoria   3800

Dear Mr Seah

Thank you for your application of 25 May 2000 in which you request permission to conduct a research study in government schools titled: *The negotiation and portrayal of values by migrant/foreign mathematics teachers in Australia.*
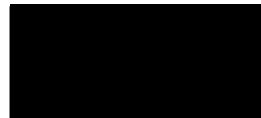
I am pleased to advise that on the basis of the information you have provided your research proposal is approved in principle subject to the conditions detailed below.

1.   Should your institution's ethics committee require changes or you decide to make changes, these changes must be submitted to the Department of Education, Employment and Training for its consideration before you proceed.

2.   You obtain approval for the research to be conducted in each school directly from the principal. Details of your research, copies of this letter of approval and the letter of approval from the relevant ethics committee are to be provided to the principal. The final decision as to whether or not your research can proceed in a school rests with the principal.

3. No student is to participate in this research study unless they are willing to do so. The principal will make the decision as to whether or not the permission of parents or guardians is needed. If parental permission is required by the principal, sufficient information must be provided to enable parents to make an informed decision and their consent must be obtained in writing.

4. As a matter of courtesy, you should advise the relevant Regional Director of the schools you intend to approach. An outline of your research and a copy of this letter should be provided to the Regional Director.

5. Any extensions or variations to the research proposal, additional research involving use of the data collected, or publication of the data beyond that normally associated with academic studies will require a further research approval submission.

6. At the conclusion of your study, a copy or summary of the research findings should be forwarded to me at the above address.

I wish you well with your research study. Should you have further enquiries on this matter, please contact Steve Sullivan, Project Officer Research, School Community Support Branch, on 9637 2347.

Yours sincerely

PETER HAYES
A/Assistant General Manager
School Staffing & Operations

encl.

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APPENDIX 3

APPROVAL TO CONDUCT RESEARCH, CATHOLIC EDUCATION OFFICE (ARCHDIOCESE OF MELBOURNE)

CATHOLIC EDUCATION OFFICE

JAMES GOOLD HOUSE
228 VICTORIA PARADE
EAST MELBOURNE VIC 3002

Telephone: (03) 9267 0228
Facsimile: (03) 9415 9325

CORRESPONDENCE TO: PO BOX 3, EAST MELBOURNE VIC 3002
Email ADDRESS: director@ceo.melb.catholic.edu.au

IN REPLY PLEASE QUOTE.

GE00/0009

2 June 2000

Mr Wee Tiong Seah
PhD Candidate / Research Assistant
Faculty of Education
PO Box 6
Monash University Vic 3800

Dear Mr Seah,

I am writing with regard to your letter of 25 May 2000 in which you referred to your forthcoming research project entitled *The negotiation and portrayal of values by migrant/foreign mathematics teachers in Australia.* I understand that this project is part of your studies for a PhD at Monash University. You have asked approval to approach Catholic secondary schools in the Archdiocese of Melbourne.

I am pleased to advise that your research proposal is approved in principle subject to the following standard conditions.

1. The decision as to whether or not research can proceed in a school rests with the School Principal. So you will need to obtain approval directly from the Principal of each school that you wish to involve.

2. You should provide each Principal with an outline of your research proposal and indicate what will be asked of the school. A copy of this letter of approval, and a copy of notification of approval from the University's Ethics Committee, should also be included.

3. No student is to participate in research study unless s/he is willing to do so and informed consent is given by a parent/guardian.

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4. You should provide a list of schools which have agreed to participate in the research project to the Information Services Unit of this Office.

5. Any substantive modifications to the research proposal, or additional research involving use of the data collected, will require a further research approval submission to this Office.

6. Data relating to individuals or schools are to remain confidential. The video of students in mathematics classes should be limited to use with teachers and others involved in the research.

7. Since participating schools have an interest in the research findings, you should discuss with each Principal ways in which the results of the study could be made available for the benefit of the school community.

8. At the conclusion of the study, a copy or summary of the research findings should be forwarded to the Information Services Unit of the Catholic Education Office.

I wish you well with your research study. If you have any queries concerning this matter, please contact Mr Mark McCarthy of this Office.

With every best wish,

Yours sincerely,
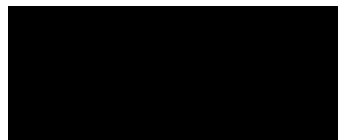
(Rev. T. M. Doyle)
DIRECTOR OF CATHOLIC EDUCATION

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APPENDIX 4

SCHOOL SURVEY MAIL-OUTS

11 July 2000

Dear ,
Survey of migrant/foreign mathematics teachers in Victoria

My name is Wee Tiong Seah, a doctoral research student in the Faculty of Education, Monash University. I am undertaking a research project under the supervision of Prof. Alan J. Bishop, a professor of education in the Faculty, entitled *'The negotiation and portrayal of values by migrant/foreign mathematics teachers in Australia'*. I am attaching with this letter an explanatory statement which provides information regarding the study.

As there is no official compilation of the distribution of migrant/foreign mathematics teachers, I am writing to all state, Catholic and independent secondary schools in metropolitan and rural Victoria to enable me construct such a state-wide profile. This will serve as useful background context for the study, as well as to provide a potential source of teacher participants.

In this light, I would be very appreciative if you could provide me with the relevant information regarding migrant/foreign mathematics teachers amongst your current staff in the reply slip overleaf. A migrant/foreign mathematics teacher is defined as one who

- *is teaching one or more of the mathematics subjects in your school,*
- *arrived in Australia from ANY other foreign country or region, including Europe, New Zealand, Asia, America, etc.,*
- *had taught mathematics in a country or region outside Australia before arriving here, and*
- *received his/her primary and secondary school education in a country or region outside Australia.*

If none of your school mathematics teacher belongs to the category defined above, please furnish a nil return so that as many schools in the state as possible may be accounted for.

All information provided by you in the reply slip will be kept confidential; access to it is restricted to my supervisor and me. Teachers identified in the form will also be invited to complete a questionnaire. Responding to the questionnaire will entirely be voluntary. A teacher may also decline to participate in any section by simply not responding to an item. Filling out and returning the questionnaire will also NOT oblige him/her in any way to participate in subsequent stages of the research study.

This project has received approval from the Department of Education, Employment and Training (approval no: SOS001539), the Catholic Education Office (approval no: GE00/0009), and Monash University's Standing Committee on Ethics in Research Involving Humans (approval no: 2000/240).

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If you have any queries or would like to be informed of the migrant/foreign mathematics teacher distribution profile, aggregate questionnaire results and/or research study findings, feel free to indicate on the reply slip below or to contact me.

Thank you very much for your attention.

Have a fulfilling day,

Wee Tiong Seah
Ph.D. candidate / research assistant
Faculty of Education
PO box 6, Monash University, VIC 3800
Tel: 9905 2876, Fax: 9905 2779
Email: WeeTiong.Seah@education.monash.edu.au

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REPLY SLIP

Migrant/foreign mathematics teachers:

Name	Home culture (e.g. Britain, Greece, Malaysia, etc)

(Tick as appropriate)
☐ Please provide a copy of the migrant/foreign mathematics teacher distribution profile.
☐ Please send me the aggregate questionnaire results.
☐ Please send me a summary of research study findings.
☐ I'm interested to find out more about the project. Please contact me.

Name: (Dr / Miss / Mr / Mrs / Ms)_____

School: _____

Postal address: _____Post code: _____

Phone no: _____   Fax no: _____

Please return this slip within a week by fax (fax no: 9905 2779) or by post (using the reply envelope enclosed). Thank you very much for your attention and time.

APPENDIX 5

ADVERTISEMENT FOR THE RESEARCH STUDY

'The negotiation and portrayal of values
by migrant/foreign mathematics teachers in Australia'
Research Project

Invitation for teacher participants

My name is Wee Tiong Seah, a doctoral research student in the Faculty of Education, Monash University. I am undertaking the above-named research project under the supervision of Prof. Alan J. Bishop, a professor of education in the Faculty. As you are aware, the nature of --- and the subsequent management of --- value conflicts as are experienced by teachers who are new to the Australian socio-cultural and educational climate are key factors to teacher professional and student academic performances.

Thus, the aims of this research project are to understand the nature of mathematics content and pedagogical value conflicts experienced by newly-arrived migrant/foreign secondary school teachers of mathematics in Victoria, to analyze the ways these teachers negotiate about the conflicts, and to research the subsequent portrayal of values. The project findings are also expected to inform the continual fine-tuning of existing professional teacher pre-service, induction and in-service programs in Victoria.

The current phase of the project involves the administering of questionnaires to migrant/foreign mathematics teachers in Victoria, regardless of their years of teaching in Australia. If you:
* *had arrived in Australia from ANY other country or region, including Europe, New Zealand, Asia, America, etc.,*
* *received your primary and secondary school education in a country or region outside Australia,*
* *had taught mathematics in a country or region outside Australia before arriving here, and*
* *are currently teaching mathematics in a Victoria secondary school,*

I am extending my invitation to you to join me by filling out the questionnaire in July (expected time spent is less than 40 minutes). Anonymity is assured in the filling out of the questionnaire. You also have the option to --- but NOT obliged to --- go on with me in the subsequent stages of this data-collecting phase, i.e. classroom observations and interviews.

To receive the questionnaire package or to find out more about the project, please feel free to contact me by telephone: ▮▮▮▮▮ fax: 9905 2779, email: ▮▮▮▮▮▮▮▮▮▮▮▮, or post/fax the reply slip below to me.

Thank you very much!
Wee Tiong Seah
Faculty of Education
Monash University, Victoria

----------✂--

❑ I'm interested to respond to your questionnaire. Please send a copy to me.
❑ I'm interested to find out more about the project. Please contact me.

Name: (Dr / Mdm / Miss / Mr / Mrs / Ms)_____

Postal address: _____

Email address: _____   Phone/fax no: _____

Please return this slip to: *Wee Tiong Seah, Faculty of Education, PO Box 6, Monash University, VIC 3800,* or fax to 9905 2779.

APPENDIX 6

LETTER OF EXPLANATION FOR TEACHERS

(Date)

(Name of teacher)
(Address of teacher)

Dear *(first name of teacher)*,

INVITATION TO PARTICIPATE IN PHASE 2
OF RESEARCH STUDY

Thank you very much for responding to the questionnaire for my doctoral research study, entitled 'The negotiation and portrayal of values by immigrant mathematics teachers in Australia'.

I am pleased that you have indicated your interest in joining me and several other teachers in the next stage of the project. The enclosed explanatory statement outlines the nature of your involvement and our partnership in this next phase of the project.

Kindly read the explanatory statement, fill in the informed consent form enclosed, and return the latter to me in the reply-paid envelope provided. At the same time, please distribute the enclosed 'letters to parents' for the class in which the observations will be carried out.

Thank you very much for your attention. If you have any queries regarding this project, please do not hesitate to contact me.

Have a fulfilling day,

Wee Tiong Seah

Encl: explanatory statement
      informed consent form
      reply-paid envelope
      letters for parents

cc: *(name of principal)*
      Principal, *(name of school)*

(Date)

Dear *(name of teacher)*,

The negotiation and portrayal of values by immigrant mathematics teachers in Australia: *Explanatory Statement*

The aims of this research project are to understand the nature of mathematics content and pedagogical value conflicts experienced by migrant/expatriate secondary school teachers of mathematics in Victoria, to analyze the ways these teachers negotiate about the conflicts, and to research the subsequent portrayal of values. The nature of – and the subsequent management of – value conflicts as are experienced by these teachers are key factors to teacher professional and student academic performances. This applies also to teachers from Britain or New Zealand, whose cultures are relatively similar to Australia's. Thus, the project findings are expected to inform the continual fine-tuning of existing professional teacher pre-service, induction and in-service programs in Victoria.

Phase 1 of the project involves the administering o : questionnaire to all migrant/expatriate secondary school teachers of mathematics in Victoria, gathering : .r opinions on values teaching in mathematics classes in the teachers' respective home cultures and in their respective Victoria classrooms. Responding to the questionnaire is not expected to take more than 40 minutes. Interested teacher respondents are then invited to join me in phase 2 of the project. Their involvement in this phase would include 3 video-recorded classroom observation sessions, pre- and post-lesson interviews, as well as the collection of a set of marked assignments. Each pre-lesson interview should last about 15 minutes, and each post-lesson interview, about 30 minutes.

The videotapes made are to be used solely for stimulating recall in the post-lesson interviews. They will only be viewed by the particular teacher participant and me, and the contents will be deleted after the interviews. On the other hand, the interviews will be audiotaped to facilitate analysis. Observation notes and interview transcriptions will also be made available to the particular teacher participant for verification.

This project has received approval from the Department of Education, Employment and Training (approval no: SOS001539), the Catholic Education Office (approval no: GE00/0009), and Monash University's Standing Committee on Ethics in Research Involving Humans (approval no: 2000/240). No findings which could identify any individual teacher participant will be published. Access to data is restricted to my supervisor and me. Coded data are stored for five years, as prescribed by University regulations.

A teacher's participation in this research study is entirely voluntary. Any teacher participant may withdraw his/her consent at any time during our partnership. He/she may also decline to take part in any part of the study.

Should you have any complaint concerning the manner in which this study is conducted, please do not hesitate to contact the Standing Committee on Ethics in Research Involving Humans at the following address:

> The Secretary, The Standing Committee on Ethics in Research Involving Humans
> PO Box 3A, Monash University, Victoria 3800
>
> (Quote: Approval no 2000/240)

Thank you very much for your attention.

Have a fulfilling day,

Wee Tiong Seah
Ph.D. candidate / research assistant
Faculty of Education
PO box 6, Monash University, VIC 3800

Informed Consent Form for Participating Teachers

**Project title: *The negotiation and portrayal of values
by immigrant mathematics teachers in Australia***

I agree to take part in the above-mentioned research project. I have had the project explained to me, and I have read the Explanatory Statement, which I keep for my records. I understand that agreeing to take part means that I am willing to:

- complete a questionnaire asking me about values and mathematics teaching in Victoria and in my home culture,
- allow between 4 to 6 lessons to be observed and videotaped,
- be interviewed by the researcher,
- allow the interviews to be audiotaped,
- present a set of student marked assignments to the researcher.

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 on the project, or to any other party.

The videotapes in the project will be used solely for the purpose of stimulating recall in the interviews, and my name will not appear. The videotapes will be destroyed after the interviews.

I also understand that my participation is voluntary, that I can choose not to participate in part or all of the project, and that I can withdraw at any stage of the project without being penalized or disadvantaged in any way.

Please tick the appropriate box:

❏ The information I provide can be used in future similar or related research projects which have ethics approval as long as my name and contact information are removed.

OR

❏ The information I provide cannot be used except for this project.

Name: .... (please print)

Signature: ....   Date: ....

Class identified for study: ....   Weekly contact: ...... lessons X ...... mins

Kindly return this form to me using the enclosed reply-paid envelope. Thank you!

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(Date)

Dear parents,

THE NEGOTIATION AND PORTRAYAL OF VALUES BY IMMIGRANT MATHEMATICS TEACHERS IN AUSTRALIA

My name is Wee Tiong Seah, a doctoral research student in the Faculty of Education, Monash University. I am undertaking the above-named research project under the supervision of Prof. Alan J. Bishop, a professor of education in the Faculty.

As you are aware, the nature of – and the subsequent management of – value differences as are experienced by teachers in an increasingly multicultural and multiethnic society are key factors to teacher professional development and student academic performance. Thus, the aims of this research project are to understand the nature of mathematics content and pedagogical value differences experienced by migrant secondary school teachers of mathematics in Australia, to analyse the ways these teachers negotiate about the differences, and to research the subsequent portrayal of values. The project findings are also expected to inform the continual fine-tuning of existing professional pre-service, induction and in-service programs for teachers in Victoria.

Your child's school is one of the participating schools in my project. I am privileged to be given the opportunity to enter your child's mathematics lessons for a total of three times in Term 2 this year to observe your child's mathematics teacher, Mr Khaliq Nasser (pseudoymn). A video-camera will be **focussed on him** during the classroom observations as a means of stimulating recall during my post-lesson interviews with Mr Nasser. One set of your child's marked/graded assignment will also be nominated and submitted by Mr Nasser for an analysis of his written response to student work.

This project has received approval from the Department of Education, Employment and Training (approval no: SOS001539) and Monash University's Standing Committee on Ethics in Research Involving Humans (approval no: 2000/240). No findings which could identify any individual student, teacher or school will be published or reported. The contents of the video-tapes will only be seen by me and Mr. Nasser. All video-tapes will be destroyed after the interviews. Examined assignments w⁻ʲ also be returned to your child.

I appreciate your understanding and support in allowing me to video-tape your child's class proceedings and to gather data through your child's assignment. Please be advised that if you object to any aspect of this intended research in your child's class, you may contact your child's principal.

Thank you very much for your attention, understanding and support. If you have any other general queries about the research study, please feel free to contact me (contact details below).

Regards,

Wee Tiong Seah
Faculty of Education
PO Box 6, Monash University
VIC 3800

----------------------------✂---

I understand the information above and have no objection to Wee Tiong's presence in the classroom of my son/daughter (name) _____ with a video-camera focussed on the mathematics teacher.

Parent's name: _____   Date: _____

Parent's signature: _____

APPENDIX 7

EXAMPLE OF A LOGIC DIAGRAM

Standards (ME)

Tg at stus' speed (for yrs 7-11) ⇒ abt ½ or ⅔ of curri covered (LP1:353-354) (LP1:344, 349)
Mixed-ability class (LP1:353-354); LP2:107-110) (LP2:107)
In M'sia, stus are taught the entire syllabus for # level bf moving on to the next grade (LP1:340-346

Stus weak in algebraic manipulat^n (LP1:17-21; LP3:4-5

Yr x stus do not exhibit the skills at that yr level in Aust (LP1:338-340; LP3:10-13)

In Aust, stus need not be taught everything bf they move up one grade if they can't cope (LP3: 46-49

Except stus in prestigious schs, may have to assume zero prerequisite K (LP2:90-97)

Stus still cannot find intercepts, or they take a long time (LP2:185-188)

~~Time taken up~~

Time taken up tg stus the skills they don't know (LP1:71-73, 81-82

M'sia – greater emphasis on basic numeracy skills (eg 4 ops) (LQ42b)

Aust – stus who can't cope expect trs to teach at their level instead (LC)

M'sia – stus who can't cope would look for help, eg home tuition (LC)

(own time)
Give extra class, (LP1:71-72, 84-98

As is the norm here,
  gd ones — they go ahead w/ set work
  middle ones — pitch the lesson at them
  slow ones — give them modified work (LP1:354-362; 375, 386, 389, 397, 399

But, for the yr 12 class, VCE ⇒ all have to move together (LP1:380-386

√ Unique way of tg: cumbersby worked eg & etc (LP1:108-149 2LL1:1707)
√ Need to revise w/ stus the basics (LL1:1434; LP2:116-120, 110-111)

√ Stu practice w/ what they shd know in the world egs (LL1:1340, 1414; LL2:1439; LL3:1095?, 1033)

Csq This doesn't mean the slower stus can catch up? (LP1:401-404)

(P) need to adapt to local situat^n (LC)

Finds it demanding to cater to the 3 ability grps in the classroom (LP1:357)

Used to be upset, not anymore (LP2:97-103

Felt that he's not doing justice to the brighter kids (not much help from trk bogged down by classmates) (LP1:358-360

Demands of VCE (for the yr 12 classes) (LP1:380-386

APPENDIX 8

SCHOOL SURVEY SLIPS

---✂---

REPLY SLIP

Migrant/foreign mathematics teachers:

Name	Home culture (e.g. Britain, Greece, Malaysia, etc)

(Tick as appropriate)

❑ Please provide a copy of the migrant/foreign mathematics teacher distribution profile.

❑ Please send me the aggregate questionnaire results.

❑ Please send me a summary of research study findings.

❑ I'm interested to find out more about the project. Please contact me.

Name: (Dr / Miss / Mr / Mrs / Ms)_____

School: _____

Postal address: _____Post code: _____

Phone no: _____   Fax no: _____

Please return this slip within a week by fax (fax no: 9905 2779) or by post (using the reply envelope enclosed). Thank you very much for your attention and time.

APPENDIX 9

TEACHER QUESTIONNAIRE

The negotiation and portrayal of values

by immigrant mathematics teachers

in Australia

Faculty of Education

Monash University

Teacher Questionnaire

Please return this questionnaire using the reply-paid envelope

or by fax (9905 2779; attn: Wee Tiong Seah)

PART A: ABOUT YOURSELF

1. Gender:

☐ male

☐ female

2. Country in which you received (most of) your school
mathematics education   : _____

3. Country in which you received (most of) your teacher education
training   : _____

4. Your **home culture** (i.e. *the culture in which you have spent
most of your life*, e.g. mainland Chinese, Indian, Indonesian
Malay, Malaysian Chinese, Italian, Scottish, American Korean,
etc)   : _____

5. Teaching career:

Country	Period	Level (pri/sec)	Employment type (full/part-time)	Employment status (ongoing/contract/casual)
Australia	--- current			

7. Present school system:

☐ State

☐ Catholic

☐ Independent

8.

Subject(s) teaching (2000)	Year level(s) (plse circle)
☐ Mathematics	7 8 9 10
☐ Further mathematics	11 12
☐ Maths methods	11 12
☐ Specialist mathematics	11 12

9. Cultural mix of your own pupils in 2001:

General cultural type	Approx percentage
Similar to yours	
Different from yours	

10. In the mathematics you learnt at school as a pupil, was there any reference to the mathematics generally practised in your home culture?

☐ Yes

☐ No

Comments (if any):

_____

_____

_____

_____

_____

PART B: YOUR OPINIONS AND VIEWS

For each of the statements below, please tick in the appropriate box to indicate the extent to which you agree or disagree with it.

	Strongly Agree 1	2	Neutral 3	4	Strongly Disagree 5
11. The rationale of school mathematics education in Australia and in my home culture are similar.	☐	☐	☐	☐	☐
12. In my **home culture**, it is very important to do well in mathematics at school.	☐	☐	☐	☐	☐
13. In **Australia**, it is very important to do well in mathematics at school.	☐	☐	☐	☐	☐
14. The school mathematics taught in my **home culture** is mostly facts and procedures that have to be memorized.	☐	☐	☐	☐	☐
15. The school mathematics taught in **Australia** is mostly facts and procedures that have to be memorized.	☐	☐	☐	☐	☐
16. Pupils in Australia learn more mathematics topics than pupils in my home culture.	☐	☐	☐	☐	☐
17. There is a greater emphasis on the applications of mathematical knowledge in the Australian mathematics curriculum than in the curriculum of my home culture.	☐	☐	☐	☐	☐
18. There is a greater emphasis on mental or paper-and-pencil computation skills in the mathematics classroom of Australia than of my home culture.	☐	☐	☐	☐	☐

351

	Strongly Agree		Neutral		Strongly Disagree
	1	2	3	4	5

19. Pupils in my home culture are given more
mathematics assessments than pupils in Australia. ☐ ☐ ☐ ☐ ☐

20. The operations of the present school I am teaching in
are guided by a set of stated institutional values. ☐ ☐ ☐ ☐ ☐

21. My present school's mathematics curriculum specifies
a set of desirable outlooks / traits. ☐ ☐ ☐ ☐ ☐

22. In my Australian classes, I only make use of teaching
notes, worksheets and/or overhead transparencies
which I had developed in my home culture. ☐ ☐ ☐ ☐ ☐

23. I always try colleagues' successful mathematics
teaching strategies out with my pupils. ☐ ☐ ☐ ☐ ☐

24. My mathematics teaching in Australia follows closely
the mathematics curriculum guidelines given to me. ☐ ☐ ☐ ☐ ☐

25. I involve my pupils in Australia in more drill
practices than pupils in my home culture. ☐ ☐ ☐ ☐ ☐

26. My responses to the same classroom incident
in different classes are identical. ☐ ☐ ☐ ☐ ☐

27. In Australia, I teach mathematics in the same
way as I did in my home culture. ☐ ☐ ☐ ☐ ☐

28. There are parents of my pupils in Australia who object
to my mathematics teaching style. ☐ ☐ ☐ ☐ ☐

29. My pupils have expressed concerns at the
way in which I teach mathematics. ☐ ☐ ☐ ☐ ☐

		Strongly Agree		Neutral		Strongly Disagree
		1	2	3	4	5

30. The physical space and/or layout of my mathematics classroom in Australia facilitates my teaching of desirable outlooks / traits to my pupils.

☐ ☐ ☐ ☐ ☐

31. The **mathematical knowledge** I teach in Australia has to reflect the Australian cultural values.

☐ ☐ ☐ ☐ ☐

32. **The way I teach mathematics** in Australia has to reflect the Australian cultural values.

☐ ☐ ☐ ☐ ☐

33. Depending on the country I am teaching in, my mathematics lessons portray different underlying values or messages to my pupils.

☐ ☐ ☐ ☐ ☐

34. Part of my teaching experience is to be able to formulate automatic responses to classroom incidents.

☐ ☐ ☐ ☐ ☐

Comments (if any):

_____

_____

_____

_____

_____

For each item below, some of the different ways in which the statement may be completed are given. Rank these phrases accordingly in the accompanying boxes, where '1' indicates your first choice, '2' your second choice, etc. A tie may be represented by, for examples, (1, 2, 2, 4, 5) or (1, 1, 1, 4, 5). If a choice is not applicable to you, please indicate it with 'N/A' in the corresponding box. Do not leave any box blank.

35. My **preferred** teaching style involves:

Ranking

- direct instruction. ☐
- drills practice. ☐
- investigations. ☐
- problem-solving. ☐
- small-group work. ☐
- testing. ☐
- use of the textbook. ☐
- Others (please specify): _____ ☐

36. My teaching style **in my home culture** involves:

Ranking

- direct instruction. ☐
- drills practice. ☐
- investigations. ☐
- problem-solving. ☐
- small-group work. ☐
- testing. ☐
- use of the textbook. ☐
- Others (please specify): _____ ☐

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37. My teaching style in **Australia** involves:

Ranking

- direct instruction. ☐

- drills practice. ☐

- investigations. ☐

- problem-solving. ☐

- small-group work. ☐

- testing. ☐

- use of the textbook. ☐

- Others (please specify): _____ ☐

38. In my **home culture**, I tried to instil desirable outlooks/traits in my mathematics pupils through:

Ranking

- encouraging a common style of presenting solutions. ☐

- my classroom activities. ☐

- my classroom management style. ☐

- the content of my teaching. ☐

- the context in problem sums. ☐

- Others (please specify): _____ ☐

39. In **Australia**, I try to instil desirable outlooks/traits in my mathematics pupils through:

Ranking

- encouraging a common style of presenting solutions. ☐

- my classroom activities ☐

- my classroom management style. ☐

- my content teaching. ☐

- the context in problem sums. ☐

- Others (please specify): _____ ☐

40. The outlooks/traits I promote in my mathematics teaching are influenced by:

Ranking

- my perception of the future career demands of my pupils. ☐

- my personal values. ☐

- my religious/spiritual values. ☐

- the assessment system. ☐

- the kind(s) of pupils I have with me in my classroom. ☐

- the kind(s) of teaching materials that are available for me to use. ☐

- the school ethos and culture. ☐

- the society and culture I am teaching in. ☐

- Others (please specify): _____ ☐

41. Faced with a mathematics classroom incident involving conflicting cultural values, my response as a teacher is:

Ranking

- different for each different cultural group of pupils in the class. ☐

- guided by my home culture's values. ☐

- guided by my personal values. ☐

- guided by my religious / spiritual values. ☐

- guided by the Australian cultural values. ☐

- guided by the school community's / parents' concerns. ☐

- guided by the school ethos / culture. ☐

- the same as the one I adopted for another class. ☐

- to ignore the classroom situation. ☐

- to try out a proven strategy used by a colleague before. ☐

  - Others (please specify): _____ ☐

Comments (if any):

_____

_____

356

Your personal experience and reflection are of great value in helping you respond to the three items below. As in the previous sections, there is no right or wrong answer to each item. Please feel free to attach additional pieces of paper to the questionnaire if you require more writing space.

42. (a) What do you think is the most significant difference between the way **mathematics as a discipline** is perceived in your home culture and taught in Australia?

_____

_____

_____

_____

_____

(b) In your opinion, what are the respective cultural values that underpin this difference?

_____

_____

_____

_____

(c) How has this difference influenced your teaching?

_____

_____

_____

_____

(d) How have the school, community, state and/or national policies made it easier or harder for you to respond to this difference?

_____

_____

_____

_____

_____

43. (a) What do you think is the most significant difference between the **school mathematical knowledge** taught in your home culture and taught in Australia?

_____

_____

_____

_____

_____

_____

(b) In your opinion, what are the respective cultural values that underpin this difference?

_____

_____

_____

_____

_____

_____

(c) How has this difference influenced your teaching?

_____

_____

_____

_____

_____

_____

(d) How have the school, community, state and/or national policies made it easier or harder for you to respond to this difference?

_____

_____

_____

_____

_____

_____

44. (a) What do you think is the most significant difference between the way school mathematics is taught in schools in your home culture and in Australia?

_____

_____

_____

_____

_____

(b) In your opinion, what are the respective cultural values that underpin this difference?

_____

_____

_____

_____

_____

(c) How has this difference influenced your teaching?

_____

_____

_____

_____

_____

(d) How have the school, community, state and/or national policies made it easier or harder for you to respond to this difference?

_____

_____

_____

_____

_____

PART C:	IN CONCLUSION

45. Would you be interested to join me in the subsequent stages (involving 3 classroom observations and interviews) during **Term 3 or Term 4, 2001?**

☐ Yes.

    Your name: _____

    Correspondence address: _____

    Ph: (BH) _____ (AH) _____

    Email: _____

    Present school name: _____

    Please circle the months which will be convenient for you to work together with me:

    Sep 2001 / Oct 2001 / Nov 2001 / Dec 2001 / Feb 2002 / Mar 2002

☐ No, thank you.

☐ Not certain yet; you will keep me informed.

    Your name: _____

    Correspondence address: _____

    Ph: (BH) _____ (AH) _____

    Email: _____

    Present school name: _____

Today's date: _____ 2001

Thank you, once again, for responding!

Wee Tiong Seah
Faculty of Education
PO Box 6, Monash University
VIC 3800

APPENDIX 10

LESSON OBSERVATION CHECKLIST

Class Visit

Teacher: _____   Date/Time: _____

Class: _____   Topic: _____

Checklist: ❏ Video camera
            ❏ Tripod
            ❏ Blank video tape
            ❏ Extension cord

Time	Math^{cal} value portrayed Teaching style observed Decision made Unusual/missing event	Notes & Comments

Time	Mathematics educational value portrayed Teaching style observed Decision made Unusual/missing event	Notes & Comments

Time	General educational value portrayed Teaching style observed Decision made Unusual/missing event	Notes & Comments

APPENDIX 11

DISCUSSION AND INTERVIEW PROTOCOLS

Preliminary conversation log

Teacher: _____   Date/time : _____

Thank teacher, keep him/her at ease, reassure him/her that this is work with him/her to
learn more, and NOT to judge his/her teaching.

Background

When did you come to Australia?
Why did you decide to leave your home
    country?
Why did you choose Australia?
Who came with you to Australia?

Why did you become a teacher?
Why do you continue to teach after arriving
    in Australia?

What is the social status of teachers in your
    home culture?
How is it different in Australia?

For the class we will be working in, what is
    the student ethnicity profile like?

Values and mathematics education

What in your opinion are values?
How do you think values are being portrayed
    in mathematics teaching?
What are the key values which you portray in
    your mathematics classes?

Value conflicts

What is mathematical knowledge and what is
    its role in today's society??
To what extent do your views reflect that of
    your home culture's?
How has your own view of mathematics
    helped/hindered your teaching in
    Australia?

What do your think mathematics teaching is
    all about?
To what extent do your views reflect that of
    your home culture's?
How has your own view of mathematics
    teaching helped/hindered your teaching in
    Australia?

Tell me about one or two personal incidents
    which illustrate value conflicts.

Resolving value conflicts

How have you changed in terms of teaching
    style and philosophy after teaching in
    Australia?

Institutional and societal roles

Housekeeping matters

Present teacher with explanatory letter and informed consent form

Present teacher with principal information letter and parents' consent letter

Arrange lesson observation dates and times.

Confirm interview venues and times.

Arrange for room with VCR and TV for viewing after observations.

Check out classroom (check for power-points)

Do you know of any other migrant/expatriate teacher of mathematics in Victoria?

Thank you for your time.

Post-lesson Conversation Log

Teacher: _____   Date/Time: _____

Checklist: ❑ Audio-tape recorder
            ❑ Audio-tape
            ❑ Video tape
            ❑ TV (tuned) and VCR (set-up)

----

1. How did the lesson go?

2. Tell me about the **on-the-spot decisions** you had to make in class today.
   - What are the considerations involved?
   - To what extent is one or more of these considerations attributed to your own cultural values?
   - When these considerations interact, is the outcome always what has been observed today?

3. What was different between your **intended and actual order of presentation**?
   - What are the considerations involved?
   - To what extent is one or more of these considerations attributed to your own cultural values?
   - When these considerations interact, is the outcome always what has been observed today?

4. What was different between your **intended and actual teaching style**?

– What are the considerations involved?

– To what extent is one or more of these considerations attributed to your own cultural values?

– When these considerations interact, is the outcome always what has been observed today?

5. What was different between your **intended and actual value portrayal**?

– What are the considerations involved?

– To what extent is one or more of these considerations attributed to your own cultural values?

– When these considerations interact, is the outcome always what has been observed today?

6. I noticed in the lesson that (*see below*).

– What are the considerations involved?

– To what extent is one or more of these considerations attributed to your own cultural values?

– When these considerations interact, is the outcome always what has been observed today?

7. Any other **comments**?

8. **Outstanding questions** from previous interview(s):

9. Thank you. I look forward to our next meeting (*arrange / confirm*)

OR

I'll collect from you a set of marked **student work** now, which I will return tomorrow by post.

Thank you very much for your participation. (*Discuss possible developments*)

APPENDIX 12

CODING LIST

Tbg	teacher participant's background information
Tva	teacher participant's personal values
MD — *	mathematical[1] value difference/conflict
ME — *	mathematics educational[1] value difference/conflict
ED — *	general educational[1] value difference/conflict
* — Des	description of value difference/conflict
* — Cxt	immediate context of value difference/conflict
* — Str	teacher strategy to negotiate value difference/conflict
* — Asm	teacher assumption in adopting the strategy
* — Csq	consequence of the strategy adopted
Ins ±	facilitating/impeding institutional factor
Soc ±	facilitating/impeding social factor
Cxt — Glo	global coherence[2], related to teacher participant's overall intent during the interviews / lessons
Cxt — Tml	themal coherence[2], related to teacher participant's underlying beliefs, goals, etc
Ā	negative evidence of phenomenon A

Notes:
[1] Three categories of values in the mathematics classroom, as proposed by Bishop (1996)
[2] Levels of themes ('coherence') proposed by Agar & Hobbs (1982)

APPENDIX 13

SAMPLE CODING OF LESSON AND INTERVIEW
TRANSCRIPTS

Note: Teacher participants' names haven been removed to preserve anonymity.

424	D:	Yeah, because if it's a turning point, it's also on the curve. But I used the original
425		point on the curve. So we put 2 in for y, equals a times 3^2 plus b times 3 plus what?
426		(Ss: 5) 5. We already know what c is. And then I can simplify this, I've got 9a+3b+5.
427		So 9a+3b+5 is going to be –3. I can simplify that too, couldn't I? Common factor?
428		
429	S:	Get the threes out.
430		
431	D:	Well common factor the 3 out.
432		
433	S:	This is very clever.
434		
435	D:	You see, I can be clever sometimes, on rare occasions.
436		Okay, that's our equation 2. And now we use systems of equations to solve. I'll just
437		leave it there, because I'm running out of time, and we have one more section to do.
438		Solve the system of equations to get a and b, and then we have the function again.
439		
440	S:	So I can just take out all the threes, and things —
441		
442	D:	Oh, what I did was I factored out 3 from both sides, and then divide both sides by 3.
443		Alright, and then, 21.1. Now, Chapter 19 is where you'll be looking for questions
444		which I'll put on the board in a minute. Questions on derivatives from 16 to 18. 21A,
445		not very much at all, just the basic integral.
446		
447	Tai:	Mrs , can I please get a practice exams to —
448		
449	D:	Oh yeah, hold on, I'll give you in a second.
450		Okay, do you remember this one? We're going backwards. We had x to the power of
451		n dx.
452		
453	Mel:	Plus c!
454		
455	D:	Plus c, Melanie! This is it! So, it's x to the power of (n+1) over (n+1) plus c.
456		Indefinite integral because we don't have any other information. We'll do another one
457		in a second where we can find out what c is. But for this one, we don't. We need to
458		have that for c. What is that going to be? What did I take the derivative of to get $3x^2$?
459		
460	Tai:	$6x^3$
461		
462	D:	What is going to happen to — x is going to go up to cube.
463		What am I dividing it by?
464		
465	Tai:	Sorry.
466		

ME - Tva
(vocab)

ME - Str

ME - Tva
(vocab)

ME - Tva
(vocab)

1   I: This is for the second period. I will go through the three things I noticed and I'll discuss
2   about the Lebanese experience as well. Do you find any difference between your experience
3   in Lebanon and in Australia now during your mathematics teaching, the difference between
4   the need to teach the concepts very well, as opposed to giving the students practice, or
5   balance between the two countries' systems?

6

7   K: Yes, of course there is, because overseas, in Lebanon, they don't prepare — that's my
8   feeling — educational systems over there doesn't prepare the students to get to the workforce
9   as soon as they can. What they try to do, they try to give students more theory, more   *ME-Des*
10   information and in terms of like studying mathematics or science, it looks like it prepares
11   them for higher education or go overseas for further studies, stuff like that. They don't   *(application)*
12   prepare the students to get a job or to get to the workplace as soon as possible. But here in
13   Australia they give the students a chance to learn a lot about theory, a lot about practical
14   applications. So kids are ready to learn about problem-solving, to solve problems from their
15   daily life or daily need.

16

17   I: So how has that affected your teaching in Australia?   *Cxt -Tml*

18

19   K: Firstly you have to adapt your mentality and your attitude to be able to do this job here *ME-Asm*
20   And the main problem is I like the way how we learn maths and science, that's why I find it
21   very interesting, to learn a lot about them, give my students a better way.

22

23   I: Do you think you will — you still try to teach them more concepts, to make sure that they
24   understand the concepts as well?

25

26   K: Yes. I still like to give them more on theory and more on concepts, and lots of explanation *ME-Str*
27   about the concept, then to give like — as well as like practical applications.

28

29   I: So you try to balance the two as well.

30

31   K: Like I said (words unclear) teaching about the differentiation. The book doesn't really give
32   the real explanation of the concept of integration. The book says integration like a total sum *ME-Asm*
33   of area underneath the graph or between the graph and the x-axis, but doesn't explain where
34   this integration sign, shaped like big 'S', comes from, which is basically the sum of small *(application)*
35   portions of areas. You have to limit of the sums, yeah.

36

37   I: (Words unclear) Some teachers will skip.

38

39   K: It doesn't exist in the book. Sometimes I find it a bit funny. One week we did derivative.
40   One of the books, it says, give explanation of the concept of derivative. It doesn't exist in that
41   book.

42

43   I: And that's the textbook that the school uses?   *ME-Des*
44

APPENDIX 14

COLLATED SURVEY DATA

VALID	ID	NAME	HC	HCCAT	SCH	SCAT	SSUB	SREG1	SREG2	MITRS	ALLTRS
1	1·1	(Name removed)	20	5	(School name removed)	3	Bundoora	1	1	1	2
1	2·1	(Name removed)	6790	2	(School name removed)	2	Traralgon	1	3		
1	2·2	(Name removed)	91	3	(School name removed)	2	Traralgon	1	3		
1	2·3	(Name removed)	91	3	(School name removed)	2	Traralgon	1	3		
1	2·4	(Name removed)	44	1	(School name removed)	2	Traralgon	1	3		
1	2·5	(Name removed)	6790	2	(School name removed)	2	Traralgon	1	3	5	20
1	3·1	(Name removed)	7	6	(School name removed)	1	Springvale Sth	1	1	1	10
1	4·1	(Name removed)	6790	2	(School name removed)	1	Mildura	2	3	1	10
1	5·1	(Name removed)	44	1	(School name removed)	3	Wendouree	1	2		
1	5·2	(Name removed)	44	1	(School name removed)	3	Wendouree	1	2	2	15
1	6·1	(Name removed)	7	6	(School name removed)	3	Elsternwick	1	1	1	4
1	7·1	(Name removed)	1	7	(School name removed)	2	Benalla	3	3	1	5
1	8·1	(Name removed)	94	3	(School name removed)	2	West Melbourne	1	1	1	7
1	9·1	(Name removed)	1	7	(School name removed)	2	Bendigo	1	1	1	18
1	10·1	(Name removed)	63	3	(School name removed)	2	Sunshine West	1	1	1	15
1	11·1	(Name removed)	1	7	(School name removed)	1	Euroa	3	3	1	8
1	12·1	(Name removed)	44	1	(School name removed)	1	Melton	3	1		
1	12·2	(Name removed)	44	1	(School name removed)	1	Melton	3	1	2	18
1	13				(School name removed)	2	Kew	1	1	0	8
1	14·1	(Name removed)	40	6	(School name removed)	2	Eltham	1	1	1	8
1	15				(School name removed)	1	Noble Park Nth	1	1	0	14
1	16·1	(Name removed)	64	1	(School name removed)	1	Leongatha	3	3	1	12
1	17·1	(Name removed)	44	1	(School name removed)	3	Keysborough	1	1		
1	17·2	(Name removed)	44	1	(School name removed)	3	Keysborough	1	1	2	10
1	18				(School name removed)	3	Campbells Creek	3	3	0	1
1	19				(School name removed)	3	Frankston Nth	1	1	0	2
1	20·1	(Name removed)	972	4	(School name removed)	3	Baxter	3	3	1	9
1	21				(School name removed)	2	Colac	3	3	0	10
1	22				(School name removed)	3	Balwyn	1	1	0	7
1	23				(School name removed)	1	Birchip	3	3	0	3
1	24·1	(Name removed)	34	6	(School name removed)	1	Seymour	3	3	1	15
1	25				(School name removed)	3	East St Kilda	1	1	0	4
1	26				(School name removed)	1	Shepparton	1	2	0	13
1	27				(School name removed)	3	Cobram	3	3	0	2
1	28				(School name removed)	2	Leongatha	3	3	0	6
1	29·1	(Name removed)	27	5	(School name removed)	2	Mulgrave North	1	1		
1	29·2	(Name removed)	65	3	(School name removed)	2	Mulgrave North	1	1	2	18
1	30				(School name removed)	2	Dooboobetic	3	3	0	6
1	31				(School name removed)	2	Myrtleford	3	3	0	6
1	32·1	(Name removed)	91	3	(School name removed)	2	Mildura	2	3	1	13
1	33				(School name removed)	2	Northcote	1	1	0	17
1	34·1	(Name removed)	1	7	(School name removed)	1	Sale	3	3		
1	34·2	(Name removed)	44	1	(School name removed)	1	Sale	3	3	2	12
1	35·1	(Name removed)	44	1	(School name removed)	3	Woodend	3	3		
1	35·2	(Name removed)	380	6	(School name removed)	3	Woodend	3	3	2	9

1	36·1	(Name removed)	1	7	(School name removed)	1	Bright	3	3	1	5
1	37				(School name removed)	1	Manangatang	2	3	0	4
1	38				(School name removed)	3	Bell Post Hill	1	2	0	5
1	39				(School name removed)	3	Junortoun	3	3	0	18
1	40				(School name removed)	1	Foster	3	3	0	8
1	41				(School name removed)	3	Mt Eliza	3	3	0	9
1	42				(School name removed)	2	Wangaratta	2	3	0	16
1	43				(School name removed)	2	Nathalia	3	3	0	8
1	44				(School name removed)	3	Malvern	1	1	0	14
1	45				(School name removed)	3	Toorak	1	1	0	11
1	46				(School name removed)	3	Hawthorn	1	1	0	1
1	47				(School name removed)	2	Springvale	1	1	0	7
1	48				(School name removed)	2	Donvale	1	1	0	16
1	49				(School name removed)	2	Windsor	1	1	0	10
1	50				(School name removed)	3	Hamilton	3	3	0	6
1	51				(School name removed)	1	Korumburra	3	3	0	7
1	52				(School name removed)	3	Wheelers Hill	1	1	0	16
1	53				(School name removed)	3	Shepparton	1	2	0	8
1	54				(School name removed)	1	Bendigo	1	2	0	20
1	55				(School name removed)	1	Bendigo	1	2	0	10
1	56				(School name removed)	1	Geelong East	1	2	0	13
1	57				(School name removed)	1	Donald	3	3	0	4
1	58				(School name removed)	1	Ouyen	2	3	0	6
1	59				(School name removed)	1	Mildura	2	3	0	12
1	60				(School name removed)	1	Edenhope	3	3	0	3
1	61				(School name removed)	1	Pakenham	3	1	0	13
1	62				(School name removed)	1	Balmoral	3	3	0	2
1	63				(School name removed)	1	Burwood East	1	1	0	13
1	64				(School name removed)	2	Heidelberg	1	1	0	15
1	65·1	(Name removed)	92	3	(School name removed)	1	Springvale	1	1		
1	65·2	(Name removed)	6790	2	(School name removed)	1	Springvale	1	1	2	7
1	66·1	(Name removed)	961	4	(School name removed)	1	Coburg	1	1		
1	66·2	(Name removed)	961	4	(School name removed)	1	Coburg	1	1		
1	66·3	(Name removed)	353	6	(School name removed)	1	Coburg	1	1	3	7
1	67·1	(Name removed)	20	5	(School name removed)	1	Thomastown	1	1	1	11
1	68·1	(Name removed)	44	1	(School name removed)	1	Casterton	3	3		
1	68·2	(Name removed)	6791	3	(School name removed)	1	Casterton	3	3	2	7
1	69·1	(Name removed)	91	3	(School name removed)	1	Bentleigh East	1	1	1	10
1	70·1	(Name removed)	6791	3	(School name removed)	1	Essendon	1	1	1	12
1	71·1	(Name removed)	30	6	(School name removed)	1	Richmond	1	1		
1	71·2	(Name removed)	39	6	(School name removed)	1	Richmond	1	1		
1	71·3	(Name removed)	380	6	(School name removed)	1	Richmond	1	1	3	7
1	72·1	(Name removed)	44	1	(School name removed)	1	Daylesford	3	3	1	10
1	73·1	(Name removed)	91	3	(School name removed)	1	Hallam	1	1		
1	73·2	(Name removed)	44	1	(School name removed)	1	Hallam	1	1	2	13
1	74·1	(Name removed)	84	3	(School name removed)	1	Footscray	1	1		

1	74-2	(Name removed)	30	6	(School name removed)	1	Footscray	1	1	2	20
1	75-1	(Name removed)	94	3	(School name removed)	3	Canterbury	1	1		
1	75-2	(Name removed)	44	1	(School name removed)	3	Canterbury	1	1		
1	75-3	(Name removed)	2	7	(School name removed)	3	Canterbury	1	1	3	22
1	76-1	(Name removed)	48	6	(School name removed)	1	Monbulk	3	1	1	8
1	77-1	(Name removed)	6791	3	(School name removed)	1	Traralgon	1	3	1	10
1	78-1	(Name removed)	852	3	(School name removed)	1	Kew East	1	1	1	17
1	79-1	(Name removed)	60	3	(School name removed)	1	Mitcham	1	1	1	11
1	80-1	(Name removed)	7	6	(School name removed)	1	Ashwood	1	1	1	9
1	81-1	(Name removed)	60	3	(School name removed)	1	Canterbury	1	1	1	17
1	82-1	(Name removed)	31	6	(School name removed)	1	Yarra Junction	3	3	1	10
1	83-1	(Name removed)	95	3	(School name removed)	1	Wodonga	2	3	1	16
1	84-1	(Name removed)	20	5	(School name removed)	1	Ringwood	1	1		
1	84-2	(Name removed)	20	5	(School name removed)	1	Ringwood	1	1	2	22
1	85				(School name removed)	1	Cohuna	3	3	0	4
1	86				(School name removed)	3	Delahey	1	1	0	3
1	87				(School name removed)	2	Werribee	1	1	0	20
1	88				(School name removed)	1	Tallangatta	3	3	0	7
1	89				(School name removed)	2	Kew	1	1	0	16
1	90				(School name removed)	1	Poowong	3	3	0	5
1	91				(School name removed)	3	Bendigo	1	2	0	3
1	92				(School name removed)	3	Sale	3	3	0	8
1	93				(School name removed)	1	Mt Beauty	3	3	0	6
1	94				(School name removed)	1	Robinvale	2	3	0	12
1	95				(School name removed)	1	Red Cliffs	2	3	0	8
1	96				(School name removed)	1	Wangaratta	2	3	0	10
1	97				(School name removed)	1	Warrnambool	1	3	0	18
1	98				(School name removed)	2	Kyneton	3	3	0	12
1	99				(School name removed)	1	Warragul	3	3	0	9
1	100-1	(Name removed)	40	6	(School name removed)	1	Heywood	3	3	1	6
1	101-1	(Name removed)	2	7	(School name removed)	3	Ballarat	1	2		
1	101-2	(Name removed)	49	6	(School name removed)	3	Ballarat	1	2	2	12
1	102-1	(Name removed)	64	1	(School name removed)	3	Newtown	1	2	1	14
1	103-1	(Name removed)	44	1	(School name removed)	1	Mooroopna	3	3	1	13
1	104-1	(Name removed)	44	1	(School name removed)	3	Kew	1	1		
1	104-2	(Name removed)	60	3	(School name removed)	3	Kew	1	1	2	15
1	105				(School name removed)	1	Newcomb	1	2	0	11
0	106-1	(Name removed)	852	3	(School name removed)	1	Thornbury	1	1		
0	106-2	(Name removed)	389	6	(School name removed)	1	Thornbury	1	1	2	?
1	107-1	(Name removed)	420	6	(School name removed)	2	Coburg	1	1	1	13
0	108-1	(Name removed)	60	3	(School name removed)	1	Dallas	1	1		
0	108-2	(Name removed)	60	3	(School name removed)	1	Dallas	1	1		
0	108-3	(Name removed)	63	3	(School name removed)	1	Dallas	1	1		
0	108-4	(Name removed)	6791	3	(School name removed)	1	Dallas	1			
0	108-5	(Name removed)	1	7	(School name removed)	1	Dallas	1	1		
0	108-6	(Name removed)	20	5	(School name removed)	1	Dallas	1	1		

0	108-7	(Name removed)	90	3	(School name removed)	1	Dallas	1	1	7	?
1	109				(School name removed)	2	Tarneit	1	1	0	9
0	110				(School name removed)	2	Toorak	1	1	0	?
1	111				(School name removed)	3	Ringwood	1	1	0	7
1	112				(School name removed)	3	Fawkner	1	1	0	3
0	113				(School name removed)	3	Mt Evelyn	3	1	0	?
0	114				(School name removed)	2	Sunbury	1	1	0	?
0	115				(School name removed)	2	Richmond	1	1	0	?
1	116				(School name removed)	3	Hawthorn	1	1	0	10
0	117-1	(Name removed)	20	5	(School name removed)	2	Preston	1	1	1	?
0	118-1	(Name removed)	91	3	(School name removed)	2	Broadmeadows	1	1	1	?
0	119				(School name removed)	2	Melton West	3	1	0	?
1	120-1	(Name removed)	27	5	(School name removed)	2	Brunswick	1	1	1	3
0	121				(School name removed)	3	Brighton East	1	1	0	?
0	122-1	(Name removed)	964	4	(School name removed)	2	Fitzroy	1	1	1	?
1	123				(School name removed)	2	Watsonia	1	1	0	12
0	124-1	(Name removed)	64	1	?	?	?	?	?	1	?
0	125				(School name removed)	1	Glenroy	1	1	0	?
1	126				(School name removed)	1	Ferntree Gully	1	1	0	13
0	127				(School name removed)	1	North Ringwood	1	1	0	?
0	128-1	(Name removed)	93	3	(School name removed)	1	Mooroolbark	3	1	1	?
0	129-1	(Name removed)	60	3	(School name removed)	1	Williamstown	1	1		
0	129-2	(Name removed)	2	7	(School name removed)	1	Williamstown	1	1	2	?
0	130				(School name removed)	2	Brighton	1	1	0	?
0	131				(School name removed)	2	Newtown	1	2	0	?
0	132-1	(Name removed)	91	3	(School name removed)	2	Frankston	1	1	1	?
0	133				(School name removed)	1	Mirboo North	3	3	0	?
1	134-1	(Name removed)	2	7	(School name removed)	2	Belgrave	1	1	1	12
0	135				(School name removed)	1	Kyabram	3	3	0	?
0	136-1	(Name removed)	1	7	(School name removed)	1	Foster	3	3		
1	136-2	(Name removed)	91	3	(School name removed)	1	Foster	3	3	2	2
0	137				(School name removed)	1	Dimboola	3	3	0	?
1	138-1	(Name removed)	91	3	(School name removed)	1	Bendigo	1	2	1	17
1	139-1	(Name removed)	1	7	(School name removed)	1	Maryborough	3	3	1	1
0	140				(School name removed)	1	Rushworth	3	3	0	?
0	141				(School name removed)	3	Portland	3	3	0	?
0	142				(School name removed)	1	Boisdale	3	3	0	?
1	143-1	(Name removed)	6790	2	(School name removed)	1	Wodonga	2	3	1	4
0	144				(School name removed)	2	Ballarat	1	2	0	?
0	145-1	(Name removed)	6790	2	(School name removed)	2	Kilmore	3	3	1	?
0	146				(School name removed)	3	Highton	1	1	0	?
0	147				(School name removed)	1	Wycheproof	3	3	0	?
0	148-1	(Name removed)	60	3	(School name removed)	1	Merbein	2	3	1	?
1	149-1	(Name removed)	2	7	(School name removed)	3	Newhaven	3	3	1	8
1	150-1	(Name removed)	60	3	(School name removed)	1	Sebastopol	1	3	1	1
0	151				(School name removed)	2	Seymour	3	3	0	?

0	152-1	(Name removed)	673	3	(School name removed)	1	Moe	1	3		
0	152-2	(Name removed)	6791	3	(School name removed)	1	Moe	1	3		
0	152-3	(Name removed)	20	5	(School name removed)	1	Moe	1	3		
0	152-4	(Name removed)	94	3	(School name removed)	1	Moe	1	3		
0	152-5	(Name removed)	6791	3	(School name removed)	1	Moe	1	3		
0	152-6	(Name removed)	44	1	(School name removed)	1	Moe	1	3	6	?
1	153-1	(Name removed)	6791	3	(School name removed)	1	Morwell	1	3	1	7
1	154-1	(Name removed)	1	7	(School name removed)	1	Glen Waverley	1	1	1	26
1	155				(School name removed)	3	Caulfield	1	1	0	4
1	156				(School name removed)	1	Frankston	1	1	0	21
0	157-1	(Name removed)	60	3	(School name removed)	1	Mt Waverley	1	1	1	3
1	158-1	(Name removed)	1	7	(School name removed)	1	Clayton South	1	1	1	10
0	159				(School name removed)	3	Wodonga	2	3	0	?
1	160-1	(Name removed)	60	3	(School name removed)	1	Balwyn North	1	1		
1	160-2	(Name removed)	60	3	(School name removed)	1	Balwyn North	1	1	2	30

APPENDIX 15

SUMMARY OF RESPONSES

TO OPEN-ENDED ITEMS IN QUESTIONNAIRE

Q ID	Difference in **mathematics as a discipline**	Underpinning cultural difference	Influence on teaching	Institutional/community support
17	Aust: mathematics not seen to be as serious as in home culture	The availability of greater career choices in Australia	accept the Australian way and adopt the new culture	(+) weekly meetings with colleagues
28	Aust: replace sound knowledge with graphics calculators H/c: maths is a way of thinking (logically)	Aust: not much value on education H/c: respects education very much	No	(-) no help rendered
29	Aust: maths is not well respected H/c: maths is admired as an area of intellectual stimulation	Influence of mathematicians in early civilisation		(-) lack of emphasis on quality of maths taught in high schools

Q ID	Difference in school mathematics	Underpinning cultural difference	Influence on teaching	Institutional/societal support
1	Aust: applications of maths H/c: rote learning of maths	fun vs jobs	flexible learning modes	
	Aust: ps strategies emphasised	In Australia, this helps students to see the relevance	Show students the relevance	(+) role of ps in society
2	Aust: applications of maths emphasised	stable employment situation	look out for real life situations	(+) differentiated VCE maths subjects
4	Aust: maths to develop skills H/c: maths based on theory and knowledge		follow guidelines set by respective education departments	(+) institutional resource (+) societal expectation of student-centredness
5	Aust: teachers trying to make maths interesting, fun H/c: maths and education are very important	Aust: good maths students perceived to be 'square' H/c: good maths students are respected by peers	adapted, but still try to raise students' maths standards	(-) school isolated her and her teaching manner (+) students and parents supportive of her success with them
6	Aust: Year 10 level is lower than in home culture	Strive for quality in home culture as Year 10 is externally assessed		
7	Aust: problem-solving and applications of priority H/c: quality presentation of written work emphasised	Greater emphasis on applications reflects the 'Pacific Rim Philosophy' (something is worth doing if it leads to profits) Relaxed approach to presentation ⇒ laidback lifestyle	need to justify what's being taught	(+) teamwork amongst staff, school enrichment program & problem competitions
	Aust: later in teaching probability, statistics and graphical work	H/c: assessment/testing approach H/c: knowledge for its own sake was more prized	need to maintain student motivation	(-) praise culture in Australia

Q ID	Difference in school mathematics	Underpinning cultural difference	Influence on teaching	Institutional/societal support
8	Aust: maths for varsity entrance H/c: maths not compulsory when students are 16	Perception in Australia that mathematical ability is related to ability to cope with difficult tertiary courses		
	Aust: less emphasis on keeping notes and learning facts		frustrated	
9	Aust: mathematics for Years 7-9 is activity-based			
10	Aust: more topics taught H/c: more time is spent for each area		go with the flow	
12	H/c: different students are taught different mathematics	Aust: less value on education Aust: education system based on elitism (vs ability)	teach more to the 'common denominator'	(-) closure of technical schools (-) too much administrative reporting
13	Aust: practical H/c: theoretical	Aust: more budget available		
15	Aust: significant number of students have no number sense H/c: all students excel in basic mathematics	Aust: relaxed attitude towards life	motivate students by emphasising relevance of number	(-) getting comments like "don't be too hard on the students"
	H/c: students are 1 or 2 years ahead of Australian students in terms of level and depth	Aust: celebrate creativity and expression H/c: logical thinking emphasised	present mathematics as special and yet manageable	

Q ID	Difference in school mathematics	Underpinning cultural difference	Influence on teaching	Institutional/societal support
16	Aust: rigor lower	Laidback attitude in Australia		
17	Aust: applied mathematics emphasised H/c: pure mathematics emphasised	Aust: educational system responsed to technological advances	self-study to upgrade own knowledge	(+) professional courses
	Aust: less seriousness in mathematics learning	Greater career choice in Australia	accept the "shocking difference" and live with it	(+) societal emphasis on accepting difference (which also applies to different students in same class)
20	H/c: mathematics an important and compulsory school subject	Aust: relates mathematics performance to student ability		(+) integration aides for low ability students (+) after-school and across-age tuition
	H/c: investigative projects is an alien concept	the sense of insecurity and independence amongst Australian students	attempt to build up student confidence (eg by providing appropriate assignments)	
24	Aust: student lack of mathematical background	different parental expectations	lower expectations	
26	Aust: 1% of students strive for perfection H/c: everyone strive for perfection	Aust: income not related to educational level	teach at a slower pace to cater to individual students	
	Aust: activities and calculators emphasised H/c: mental skills, memorisation and other skills emphasised	Aust: less priority on success	practice no longer emphasising fact memorisation, but activity-based learning.	

Q ID	Difference in school mathematics	Underpinning cultural difference	Influence on teaching	Institutional/societal support
27	Aust: maths not compulsory H/c: maths compulsory Aust: different maths for different abilities H/c: all students do same maths	Aust: relevance of mathematics to real life is not evident to students	need to cater to students' needs, especially those who do not go on to university	(+) curriculum frameworks
	Aust: practical, activity-based, fun and enjoyable H/c: skills and concepts	Aust: students need to see relevance, and to enjoy it, in order to do well H/c: academic success key to good career	cater to student individual differences (abilities, learning styles)	(+) diagnostic tests and other resources (+) state education policies require teachers to cater to individual needs of students
28	H/c: much higher level for algebra and Euclidean geometry (incl proofs)	Aust: practical applications emphasised H/c: academic knowledge trains your brain	follow syllabus, but given freedom of choice, still teach more abstract concepts	
29	Aust: standard of mathematics is far lower than in home culture		try to emphasise some advanced topics to students to let them know what is taught overseas	(-) state/ national policies, as they are continually changing topics and lowering standards
30	H/c: an integral part of learning			
	H/c: maths more thorough. Emphasis on proofs and theorems.		No	
	H/c: no difference in expectations on gender basis			
	Aust: problem-solving and technology use H/c: students expected to know mathematics tables to 25			

Q ID	Difference in school mathematics	Underpinning cultural difference	Influence on teaching	Institutional/societal support
31	Aust: tries to make all people equal	Aust: more social engineering H/c: class structure acceptance ⇒ "understanding that we have limitations and may not all have the same opportunities"	more accepting of weaker students and the need to give them equal/more time teaching at a lower level of standard	neither way
32	H/c: considered an important subject that implies success in future life	H/c: parental/teacher pressure to excel in mathematics	tries to encourage students to do well by entertaining them with activities, applications, etc	(+) availability of resources to facilitate teaching
	Aust: reliance on calculators H/c: students learn more about applications and problem-solving skills, and understand in depth			
33	Aust: problem-solving and modelling, practical H/c: hardly any there	H/c: students don't raise questions H/c: would perceive problem-solving and modelling as a waste of time	has become an expert in problem-solving and modelling	(-) lack of time: need to cover the syllabus
	H/c: more memorising work	H/c: high esteem if student does maths/science at school	teach mathematics as a subject to be enjoyed	(-) lack of time: need to cover the syllabus
34	Aust: discovery learning and applications H/c: drills practice and procedure	Aust: more flexibility for teachers H/c: exams ⇒ cover the syllabus ⇒ help students with practice and more practice	mix of drills practices, investigative work, problem-solving, group-work, and technology	(+) school support for technology
	H/c: more depth and earlier	H/c: emphasis on exams		

Q ID	Difference in school mathematics	Underpinning cultural difference	Influence on teaching	Institutional/societal support
35	Aust: more freedom for students in class H/c: "students do what the teacher demands"	Aust: "Australia embraces TRUE democracy" H/c: "tyranny still reigns"	total embrace of Australian culture	

Q ID	Difference in mathematics education	Underpinning cultural difference	Influence on teaching	Institutional/community support
1	Aust: student-centred H/c: vs teacher-centred	less vs more respect	students can discuss within limits	
3	Aust: introduce calculators early	less vs more emphasis on numeracy	help students 'unlearn' incorrect paper-n-pencil mtds	(-) students not eager to do homework
	Aust: less breadth & depth of topics taught	student ability difference	teach at levels of students	(-) mixed-ability classes
	Aust: less homework	work ethics Australian students' access to part-time jobs and sports parental expectations different	adapt, "have to soldier on!"	
6	Aust; "do what you want/can" H/c: "maths is do-able"	Aust: success relates to external force H/c: success comes from hardwork	No	(-) national policies ⇒ students may expect gd results w/o making effort
	Aust: student-centred teaching H/c: teacher leads and students follow	respect for authority and elders		
	H/c: students only talk with permission	respect for authority and elders	time wasted disciplining students	(-) institutional sanctions not enough
	Aust: more time wasted	H/c: hardwork encouraged	time wasted disciplining students	
7	Aust: Much less use of pen and paper ⇒ Student impatience when required to produce work systematically	ICT being more pervasive in Australia	design tasks that use computers for Year 8s	(-) school emphasis on laptops (+) school PD sessions

Q ID	Difference in mathematics education	Underpinning cultural difference	Influence on teaching	Institutional/community support
5	Aust: applications of maths H/c: basic skills are drilled and practised	attitudes different ways of teaching maths no specialised maths teachers in Australia	try to change student attitudes	(-) "hard to convince people that (almost) every student can enjoy mathematics if taught properly"
	Aust: games H/c: direct instruction	Australian students don't like mathematics	try to change student attitudes	(-) "hard to convince people that (almost) every student can enjoy mathematics if taught properly"
8	Aust: more use of computers	Emphasis on technology in Australia	use computers in class more	(+) school loan of PC, etc
15	Aust: investigations, problem-solving and skills are all emphasised H/c: only skills emphasised	Aust: perception that drills are boring Aust: perception that not all people can manage numbers	less emphasis on skills	
20	H/c: drills emphasised	Aust: drills is dogmatism H/c: doing drills is like learning to walk before running	teach students how to master basic skills/ideas and to apply skills/knowledge to problems and in investigations	
27	Aust: activity-based, problem-solving, group-work, games, technology H/c: direct instruction, textbooks, testing	students' value of education students' poor memory skills in Australia		
28	H/c: direct instruction and drills, before applying on problems H/c: topics presented at various levels with increasing degree of difficulty	Aust: practical applications emphasised H/c: academic knowledge trains your brain	teach according to syllabus	

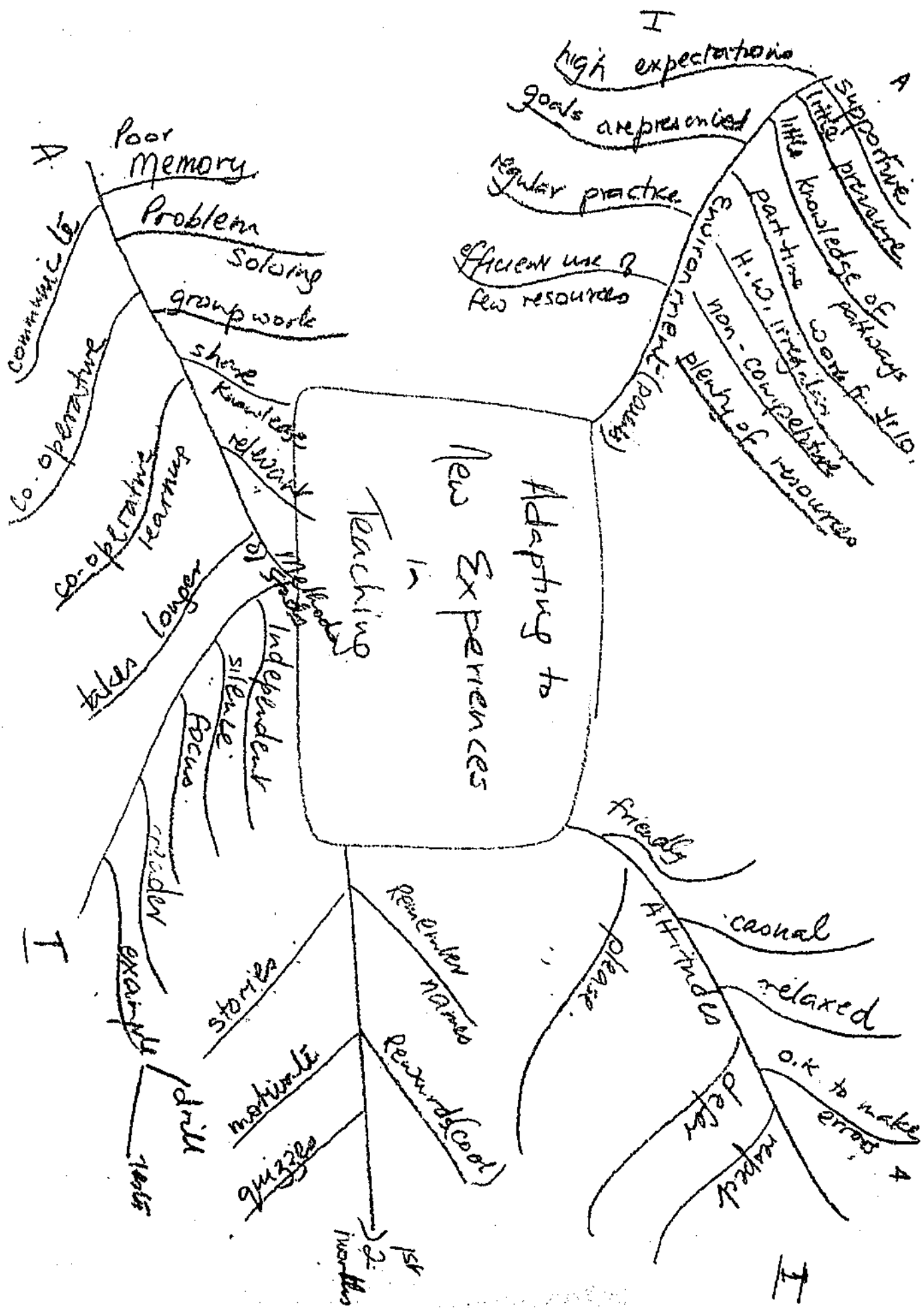| Q ID	Difference in mathematics education	Underpinning cultural difference	Influence on teaching	Institutional/community support
29	Aust: technology H/c: technology not needed to understand concepts		try to impress upon students the importance of understanding concepts and not to rely on technology always	(-) policies encourage technology use
30	Aust: no respect for teachers	Aust: no respect for teachers	positively — "knowing that my knowledge could be questioned"	(-) "my cultural ethos are not rejected, however I am expected to accept local culture"
31	H/c: "realistic selection procedures revealing weaknesses rather than accommodating for them"	Aust: young nation H/c: tradition	"used to accept the casual Australian approach. She'll be right - near enough is good enough is often the catchcry"	
	Aust: more investigations and problem-solving H/c: more formal, more drills work	H/c: class structure acceptance	more tolerant of underperformers	(-) private schools don't want trouble with clients
35	Aust: school mathematics taught "by means of positive appraisal" H/c: school mathematics "taught with a cane"	Aust: "freedom in Australia" H/c: "canes, chains, goals, missiles are their built-in culture" there	embraces Australian culture entirely	

APPENDIX 16

RANA'S CONCEPT MAP

Adapting to New Experiences in Teaching

I (top right)
- high expectations
- goals are presented
- regular practice
- efficient use of few resources
- supportive
- little pressure
- little knowledge of pathways
- part-time work
- H.W. irregular Yr 10.
- non-competitive
- Environment (poor)
- plenty of resources

A (top left)
- Poor Memory
- Problem Solving
- group work
- communic...
- Co-operative
- co-operative learning
- share knowledge
- relevant
- takes longer
- Methods
- Independent
- silence
- focus

I (bottom left)
- consider
- stories
- examples / drill
- role
- motivate
- puzzles
- Remember names
- reward (cool)
- 1st 2 months

H (bottom right)
- friendly
- casual
- relaxed
- Attitudes
- please
- o.k. to make errors
- depth
- rapport

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APPENDIX 17

VALUE DIFFERENCES PERCEIVED BY TEACHER PARTICIPANTS

Value difference	Nature [a]	Responsive approach	Contextual factors [b]
Carla			
Proof	ME	Culture-blind	(+) Personal education in proofs.
			(+) Positive student feedback.
Power distance	GE	Accommodation or Nil (helpless)	(+) Personal upbringing which emphasises respecting authority.
			(−) Student confidence
			(−) Admission of personal mistakes.
Participation	ME	Appropriation	(−) Student confidence.
			(+) Evaluation
Computational fluency	ME	Appropriation	(+) Personal upbringing in mathematics solving skills.
			(+) 'Basic knowledge gaps' amongst VCE students.
			(+) Positive student response.
			(−) Availability of student time for homework practice.
Technology	ME	Appropriation	(+) Personal proficiency in mathematics.
			(+) Positive student feedback.
			(+) Student over-reliance, even for simple computations.
			(+) Student knowledge of calculator use
			(+) Calculators not readily available in daily life.
			(−) School curriculum requirement for technology.
Deanne			
Diversity	GE	Culture-blind	(+) Multiculturalism
			(+) Mathematics as a way of learning.
			(+) Lessons' dependence on the textbook.
			(+) School support for her research into this value differences.
			(+) Little cultural variations within the school and in the community.
Professional support	O	Culture-blind	(+) Professional support network
			(+) Access to Canadian teaching resources.
Alternative assessment	ME	Accommodation	(−) Not all students do well in tests.
			(−) 'Cultural-freeze' awareness
			(−) Room within the curriculum for this form of assessing

Value difference	Nature [a]	Responsive approach	Contextual factors [b]
Power distance	GE	Accommodation	(–) Personal preference for what she encountered in Australia.
			(–) Deanne's involvement with house and senate activities.
			(–) Small school community in Australia.
Precision	M	Appropriation	(–) Student concept/skills
			(–) Student confidence
			(+) Professional induction in the 'old school' environment.
			(–) Personal doubts about the relevance of 'precision'
			(+) Promotes the values of *confidence* and *interest*
			(+) Conciseness

Manoj

Value difference	Nature [a]	Responsive approach	Contextual factors [b]
Basic skills	ME	Culture-blind	(+) Rote learning leads to understanding, which in turn leads to acquisition of basic skills useful later in mathematics and in life.
Teacher-centredness	ME	Culture-blind	(+) Student discussions are not effective.
Respect	GE	Culture-blind	(+) Important to respect teacher authority.
Relevance	ME	Accommodation	(–) Learning is to prepare students for life.
			(–) Provides students with motivation to practise basic skills.
Academic achievement	GE	Appropriation	(–) Different people have different potential.
			(–) Academic achievement is not the sole determinant of a student's success in education.
			(+) Utilise one's ability to her best.
			(–) Australian society did not value student achievement in mathematics.

Rana

Value difference	Nature [a]	Responsive approach	Contextual factors [b]
Process	ME	Culture-blind	(+) Student self-esteem.
			(–) 'Cultural-freeze' awareness
			(+) Does not hamper student creativity.
			(+) Students can thus better talk about their solutions.
			(+) School-leavers bring method along with them, not content.
			(–) Teaching schedules

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Value difference	Nature [a]	Responsive approach	Contextual factors [b]
Historical context	ME	Culture-blind	(−) 'Cultural-freeze' awareness
			(+) Personal value.
			(+) Aids student memory.
			(+) Links mathematics to other school subjects.
Conceptual understanding	ME	Appropriation	(−) 'Cultural-freeze' awareness
			(+) Personal value
			(−) Students in Australia were weaker in the mathematical language.
Mathematical language	ME	Appropriation	(+) Student self-esteem
			(−) Conceptual understanding
			(−) 'Cultural-freeze' awareness
			(+) Important for daily communication.
Groupwork	ME	Appropriation	(−) 'Cultural-freeze' awareness
			(−) Trust.
			(−) Peer-teaching.
			(−) The local students' lower mathematical standard.
			(+) Maintaining the students' standards.
Betty			
Application	ME	Affinity	
Administrative support	O	Affinity	
Technology	ME	Amalgamation	(−) Efficiency.
			(+) Beauty (of mathematics).
			(+) Student inappropriate use of technology.
Khaliq			
Customisation	GE	Assimilation	(−) Student career demands.
			(−) Need not necessarily prepare students for exams.
			(−) Support from school, community, state and/or national policies.
Applications	ME	Amalgamation	(+) Concepts
			(−) Relevance of school mathematics.
			(−) Student career/life demands.
			(−) Need to reflect the Australian cultural values.
			(−) No need to prepare all students for higher education.
Assessment	ME	Appropriation	(−) Confidence
			(−) Need to reflect the Australian cultural values.
			(−) Many students don't feel valued at home.
			(+) Assessment

Value difference	Nature [a]	Responsive approach	Contextual factors [b]
Respect	GE	Appropriation	(–) Create/maintain excellent learning atmosphere.
			(–) Need to reflect the Australian cultural values.
			(+) Need to uphold the worthy values of home culture.
			(–) Relatively little respect for teachers in society
			(–) Relatively less importance placed by society on schooling
Li Kang			
Technology	ME	Assimilation	(–) Student experience of achievement / self-esteem.
			(–) Need to reflect Australian cultural values.
			(+) Technology is best introduced after skills are mastered.
			(–) Calculators introduced early on in the school years.
Practice	ME	Assimilation	(–) Need to adapt to local situation.
			(–) Students in Australia do not complete homework.
Self-esteem	GE	Accommodation	(–) 'Cultural-freeze' awareness
			(–) Need to reflect Australian cultural values.
Standards	ME	Appropriation	(–) Need to adapt to local situation.
			(+) Mixed-ability class.
			(–) Students may still move up one grade if they are not taught all the topics at current grade.
			(+) Demands of VCE at the end of Year 12.
			(–) Curriculum time limited.
			(+) Slower students expect teachers to teach to their level.
			(–) No streaming of students

Value difference	Nature [a]	Responsive approach	Contextual factors [b]
Saka			
Initiative	ME	Assimilation	(–) Expectation of teachers to give.
			(–) Policies mean that good results may be expected without much learner effort.
			(–) Examinations not a motivating factor for students.
			(–) Not as important for students to do well in school mathematics.
			(–) Academic success is due to external factors.
			(–) Mathematics achievement is constrained by one's ability.
Technology	ME	Amalgamation	(–) Student reliance on calculator.
			(+) Continual exercising of brain is essential.
Supervision	ME	Appropriation	(+) Personally values supervision
			(–) Student lack of confidence
			(–) Lower level of knowledge and quality amongst Year 10 students.

Note. [a] The nature of value difference may be:

        mathematical (M),

        mathematics educational (ME),

        general educational (GE),

        organisational (O).

[b] Contextual factors may be:

        facilitating (+), aligned with the home culture value,

        constraining ( ), aligned with the Australian value.

GLOSSARY OF TERMS

ABS	Australian Bureau of Statistics
AustAID	Australian Agency for International Development
CAS	Computer algebra system
CQ	cultural intelligence
CSF	Curriculum and Standards Framework
EQ	emotional intelligence
ICT	information and communication technology
IQ	intelligence quotient
NCTM	National Council of Teachers of Mathematics
OECD	Organisation for Economic Co-operation and Development
PISA	Programme for International Student Assessment
SES	socio-economic status
TIMSS-R	Third International Mathematics and Science Study-Repeat
UNESCO	United Nations Educational, Scientific and Cultural Organization
VCE	Victorian Certificate of Education
VIT	Victorian Institute of Teaching