Chapter 4-6

TRIP FOR THE BODY, EXPEDITION FOR THE SOUL: AN EXPLORATORY SURVEY OF TWO EAST ASIAN TEACHERS OF MATHEMATICS IN AUSTRALIA

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1. INTRODUCTION

Much of the (mathematics) educational research community's knowledge, understanding and comparison of different cultural and educational traditions has come about through studies which compare institutional policies, curriculum statements, textbooks, learning environments, student work and/or teacher/student affect in their respective cultural settings, a notable example being the series of international mathematics and science studies. The teacher, too, is an important focus in any study of mathematics education in different traditions (ICMI, 2000). While this chapter aims to contribute understanding and knowledge in this specific area involving teachers, their values and their subsequent decisions and actions, it also seeks to do so through using a different approach, i.e. through investigating the professional experience and practice of individual teachers of mathematics across different East Asia-Western cultural settings.

Specifically, this chapter represents the voices of two East Asian teachers of mathematics who had migrated to Australia over different periods in time. Although it is multi-ethnic in its demographic makeup, Australia's historically colonial links with Britain and a period of 'learning from the United States' in major cities such as Melbourne have meant that the dominant societal culture in Australia is Anglo-Saxon. Through the value differences

these teachers encountered in the Australian mathematics classroom, we can "identify similarities and differences, and ... interpret and explain the similarities and differences identified" (ICMI, 2000) in the mathematics education systems in East Asia and in Australia. The chapter also reveals that as East Asians in the West, these immigrant teachers may have transported themselves physically into the Australian classroom, but the corresponding journeys of their souls have often been ones with numerous obstacles, dilemmas and uncertainties. Lastly, but no less importantly, the ways in which these immigrant teachers negotiate the value differences in their mathematics classrooms point to possibilities of how these differences may lead to an optimisation of school mathematics instruction in a Western culture such as Australia's, and also in the East Asian context.

2. SOCIO-CULTURAL NATURE OF MATHEMATICS AND MATHEMATICS EDUCATION

Some of the underlying factors behind different mathematics education systems in East Asia and in the West are due to the socio-cultural nature of both mathematical knowledge and mathematics education. The birth and development of mathematical systems are linked to particular needs of respective societies (Ascher & D'Ambrosio, 1994; Bishop, 1991). For example, it is reasonable to assume that 'Western' mathematics had not developed from the same impetus accounting for the beginning of the Chinese mathematical system in the early Chinese civilisation. Of course, it may be difficult to define 'Western' mathematics because it has certainly evolved through direct influences from many cultures itself, including the Chinese culture (Bishop, 1990). In fact, that the two traditions have developed differently reinforces the socio-cultural gap existing between (East) Asia and the West.

Also, school mathematics education is a socially-referenced activity (Cobb, 1996; Keitel, Damerow, Bishop, & Gerdes, 1989). Since countries in East Asia and in the West are in different stages of national development, the mathematics curricula in different nations are designed to serve the respective nations' current and unique developmental, societal and economic needs. Also, what appear to be similar mathematics curricula may be taught through different perspectives and approaches. Even similar teaching aids may be used to achieve different pedagogical aims (see Brenner, Herman, Ho, & Zimmer, 1999, for example, for an illustration of the different purposes of using manipulatives in Asian and American classrooms).

3. VALUES RELATED TO MATHEMATICS AND MATHEMATICS EDUCATION

Cultures are intricately related to values. Den Brok, Levy, Rodriguez and Wubbels (2002) define culture as

> the ever-changing values, traditions, social and political relationships, and worldview created and shared by a group of people bound together by a combination of factors (which can include a common history, geographic location, language, social class, and/or religion), and how these are transformed by those who share them. (p.448)

To McConatha and Schnell (1995), culture is "an organised system of values which are transmitted to its members both formally and informally" (p.81). Thus, differences in the mathematics education systems in East Asia and in the West can possibly be understood in terms of differences in values. As a cultural construct, values may be seen to have been internalised from affective qualities such as beliefs and attitudes (Krathwohl, Bloom, & Masia, 1964; Raths, Harmin, & Simon, 1987).

Values in the context of mathematics education represent one's internalisation, 'cognitisation' and decontextualisation of affective variables (such as beliefs and attitudes) in one's socio-cultural context. They are inculcated through the nature of mathematics and through one's experiences in one's socio-cultural environment and in the mathematics classroom. These values form part of one's ongoing and developing personal value system, which equips one with cognitive and affective lenses to shape and modify one's ways of perceiving and interpreting the world, and to guide one's choices of course of action. In general, values in mathematics education may be categorised as mathematical, mathematics educational, and general educational (Bishop, 1996), and are collectively part of broader categories of personal, institutional, epistemological and societal values (Seah & Bishop, 2000). According to Bishop (1988), 'western' mathematics may be regarded to value mathematical qualities like 'rationality', 'objectism', 'control', 'progress', 'mystery' and 'openness'. Teacher professional practice and mathematics education norms also transmit mathematics educational values such as 'technology', 'reasonableness' and 'applications', although the extent to which each is emphasised (or not) can differ amongst cultures. Certainly, interactions within a micro-version of society such as the mathematics classroom sees the portrayal of general educational values such as 'honesty', 'organisation' and 'respect' as well.

The data shown in this chapter is part of a bigger-scale questionnaire survey. The two immigrant East Asian teachers filled out the questionnaire in a place and at a time which each felt most comfortable and least restrictive.

The 45-item, 12-page questionnaire consisted of open- and closed-ended questions which encouraged the teacher participants to explore and examine the mathematics education traditions, and their pedagogical practices, in their respective home cultures and in Australia.

4. VALUE DIFFERENCES BETWEEN MATHEMATICS CLASSROOMS IN EAST ASIA AND IN THE WEST

Cultural value differences in this chapter refer to the immigrant teachers' perception of differences in which their respective home cultures and the Australian culture place importance over mathematical knowledge, school mathematics curriculum, or mathematics teaching/learning. What constitutes the Australian culture in this chapter would be the cultural order which each of the immigrant teachers perceives of Australia. In this sense, different notions of Australian culture can be associated with different immigrant teachers, but in many ways it can be argued that the Australian culture is indeed a construction within the lived experience of the individual involved. Importantly, it is the reference against which the immigrant teacher interprets the social world around him in his Australian mathematics classroom, and against which value differences are perceived.

The two immigrant teachers identified seven main value differences (see Table 1). Corresponding to each of these value differences is the respective teacher's identification of the factor(s) underlying the observed differences. These opinions generally correspond to each of the teacher's professional identity, a glimpse of which was discerned from the teacher's responses to the inter-related questionnaire items. It is perhaps expected that these value differences experienced in the mathematics classrooms cut across the intended, implemented and attained curricula (the curriculum comparative model adopted by the IEA's International Mathematics and Science Studies). More useful in our ongoing attempt to better understand the differences across cultures perhaps, is to relate these value differences to the five universal dimensions of cultural variability proposed by Geert Hofstede (1997). These dimensions are, namely, power distance, relationship of self to community, achievement orientation, uncertainty avoidance, and life orientation. They were conceptualised as a result of a survey of more than 100,000 employees of a multinational firm in more than 50 countries in the 1970s. Based on the scores calculated for the participating countries, each country occupies a position along each of the dimension continua, so that comparisons may be made between/among countries along any of these

dimensions. Alternatively, each country may be seen to be uniquely identified by its cultural characteristics in five-dimensional space. The variety of relations between people in different countries, categorised into four co-existing but conflicting 'cultural projects' by Douglas (1996), may indeed be seen to be one way through which such five-dimensional cultural characteristics find expression.

Table 4-6-1. Value differences experienced by immigrant teachers of mathematics in Australia

Value difference (Australian culture / home culture)	*Underlying factor(s)*	*Dimension of cultural variability*
Teacher co-constructs knowledge / teacher dispenses knowledge	Authority of teacher in society	Power distance (small — big)
Mathematics as object of fear / mathematics as object of beauty	Difference in emphasis on contributions of mathematics to human civilisation	Self and community (individualism — collectivism)
Less content / more content	Differing relative emphasis on knowledge and skills	Self and community (individualism — collectivism)
Many mathematics subjects / few mathematics subjects	Differing relative emphasis on knowledge and skills	Achievement orientation (relationship — task)
Realistic question context / artificial question context	Differing relative emphasis on knowledge and skills	Uncertainty avoidance (weak — strong)
Specific aims / holistic aims	(Not identified by teacher)	Life orientation (short-term — long-term)
Surface understanding / deep understanding	Nature of aims of mathematics education	Life orientation (short-term — long-term)

The power distance difference between cultures may be used to explain one of the value differences experienced by Xiaoming, an immigrant teacher from China. According to him, a major part of the typical teacher training process in China is concerned with the mastery of mathematical knowledge. As such, the mathematics teacher is a respected dispenser of academic knowledge in the Chinese classroom. However, the nature of the secondary mathematics teacher training program in Australia may not be significantly different. That Xiaoming found himself playing the role of co-constructor of mathematical knowledge in his Australian classroom may actually be attributed to Australia being a relatively low power distance country (compared to China). In contrast, Hofstede points out: "in the large power distance situation .... the educational process is highly personalized ... what is transferred is not seen as an impersonal 'truth', but as the personal wisdom of the teacher .... In such a system the quality of one's learning is virtually exclusively dependent on the excellence of one's teachers" (Hofstede, 1997, p.34), thus underlining the significance of the teacher's authority in China.

Xiaoming also noted that "in China, mathematics as a discipline is perceived as an object of beauty; [whereas] in Victoria, people don't seem to see this side of mathematics, and most of them express fear of it [and perceive it] as a discipline belonging to a select few". He attributed this cultural difference to the fact that there was a greater inculcation of student awareness in China to the contributions Chinese mathematicians had made to the world and to mathematical knowledge. There is a sense that the Chinese contributions constitute a significant part of the Chinese civilisation, that it has been an achievement of the 'we' group, from which one's identity is derived. Thus, this value difference concerning students' perceived nature of mathematics can be explained by the relatively more collectivistic Chinese society and a correspondingly more individualistic Australian society.

Thomas, an immigrant teacher from Singapore, was of the opinion that the relatively bigger number of pre-tertiary mathematics subjects on offer in Australian secondary colleges can be understood in the perspective of Australia's emphasis on skills over knowledge, and of a relatively lesser Singapore emphasis in this aspect. The bigger range of mathematics subjects in Australia allows a student to take up a mathematics unit which is more related to his/her intended vocation. This difference in orientation between the two educational systems may be related to Hofstede's (1997) distinction between masculine (task orientation) and feminine societies (relationship orientation). In particular, he says: "organizations in masculine societies [in this case, Singapore] ... reward ... on the basis of equity, i.e. to everyone according to performance .... and organizations in ... [feminine] societies ... reward people on the basis of equality ..., i.e. to everyone according to need" (Hofstede, 1997, p. 93).

Thomas also noted that "assessment questions at all levels of school mathematics in Victoria tend to be more realistically contextually-based, i.e. not standard, 'designed' contexts", the latter of which tended to be found (in his view) in Singapore assessments. Here, it is supposed that 'designed' contexts refer to those where given conditions are necessarily utilised in the solution process, and where the contexts can be easily interchanged without affecting the solution strategy expected of students. In other words, context is superficially (though appropriately) crafted into the mathematics assessment items. As with some of his other observations, Thomas attributed this difference to the two countries' difference in relative emphasis over student attainment of knowledge and skills. What underpins this cultural value difference in this case, however, may well be the countries' perceived difference towards uncertainties in their common desire for content relevance to daily life. In this context, Australia is a relatively weak uncertainty avoidance society, where the nature of the mathematics assessment question

context reflects open-ended learning situations, and where multiple solutions/answers may exist.

The last cultural dimension to be considered here, that of long- versus short-term life orientations, is exemplified by Xiaoming's observation that the aims of mathematics education are (at least explicitly) different in China and in Australia. According to Xiaoming, school mathematics in China is seen as a subject which provides the necessary exercise to both hemispheres of the brain; in Australia, school mathematics promotes student reasoning and problem-solving skills. While this view highlighted particular emphases of the Chinese and Australian (mathematics) educational goals only, it does reflect the general differences in the two systems (see, for examples, Board of Studies, 2000; People's Republic of China National Education Committee, 1992; Tian, 2002). Although the desired outcomes in both countries may be largely similar, i.e. to equip students with the necessary capabilities to function in and contribute to the society, this value difference concerning aims exemplifies Xiaoming's perception of the countries' respective societal orientations. Australia's identification of more specific aims is in line with an expectation of quicker results, and may be interpreted to be expressing a concern with identifying and possessing the 'Truth' (e.g. the way to apply mathematical knowledge). On the other hand, the Chinese 'mathematics exercises the brain' approach signals a perseverance towards slower results, and while not identifying particular 'Truth', is concerned with student attainment of a 'Virtue'. These values are also reflected in the nature of the Eastern and Western religions (Hofstede, 1997), as well as in the nature of Chinese and Western medicinal approaches. Herein is a difference in terms of long-term (China) and short-term (Australia) societal orientations. In fact, China was the most long-term oriented country in Michael Bond's survey of 23 countries (including Australia at 15th place) along this dimension (Hofstede, 1997). Interestingly, in that survey, China was followed by four other East Asian nations, namely, Hong Kong, Taiwan, Japan, and South Korea.

5. NEGOTIATING VALUE DIFFERENCES ACROSS CULTURES

The value differences perceived by Xiaoming and Thomas in their own Australian mathematics classrooms have sharpened their awareness of their own cultural values relating to secondary mathematics teaching and learning. These values were inculcated in the immigrant teachers through their personal experience as children, students, and teachers in their respective home countries. Such cultural capital accompanied the teachers' arrival in Australia. The responses from both teachers have been positive and con-

structive. Specifically, Xiaoming felt that both his content and pedagogy needed to reflect the Australian cultural values, and his teaching in Australia has reflected changes to his former practice in China. His ranking of teaching styles revealed an increased use of textbooks in Australia, although he did not clarify if he was referring to the school-appointed textbook or to the big range of commercially available textbooks in Australia. Xiaoming referred to his teaching 'the Australian style' several times in his questionnaire response, which included establishing a more equal relationship with his students. Yet, he also expressed frustration whenever he perceived as confrontational student responses to his admonition. This perhaps demonstrates that Xiaoming might not have fully internalised his own attempts at practising with a local perspective.

At the same time, Xiaoming felt the need to continue to help his students appreciate the beauty inherent in mathematics, and to encourage them to share his view that mathematical practice provides the necessary exercise for the whole brain. He desired to enrich the local teaching culture with these values. Clearly, Xiaoming believed that these home cultural values related to mathematics teaching/learning can potentially contribute to a more effective pedagogical practice in Australia.

Like Xiaoming, Thomas' experiences of value differences in the Australian mathematics classroom have caused him much cognitive dissonance. For example, Thomas expressed dismay that some Australian teachers' treatment of the school-appointed textbook as seemingly teacher-proof has led to many lost opportunities of enthusing students through classroom activities, discussions and alternative modes of lesson presentations. To him, the local mathematics classroom environment was a far cry in all respects from his classroom in Singapore. At the same time, Thomas was aware of more positive aspects of the Australian mathematics curriculum, such as the structuring of mathematical problems in realistic contexts, and he was glad to be able to incorporate these into his teaching repertoire. As he put it, "I can only try to bring together the best features of the two countries' systems".

The questionnaire response from Thomas and Xiaoming appears to indicate that these immigrant teachers were involved in culture blending (see Ninnes, 1994) approaches to negotiating perceived value differences. For these teachers, perceived differences, and potential dissonance arising from the ways the home and Australian cultures value aspects of school mathematics education, were resolved through combining parts of the two cultures. At least in their professional lives, it appears that the 'melting pot' analogy of the interaction of different cultures was a useful one with which to interpret the immigrant teachers' experience, even if their personal lives may

have contributed to a 'mosaic' image of multiculturalism in an essentially Anglo-Saxon Australian society.

These teachers' responses to perceived value differences demonstrate that the mediating role of cultural (pedagogical) values needs to be taken into account in an understanding of the Piagetian processes related to equilibration. In a related study of immigrant teachers of mathematics in Australia, Seah and Bishop (2001) identified a range of teacher approaches to value differences encountered in the mathematics classroom, namely, culture-blind, assimilation, accommodation, amalgamation, appropriation (see also Bishop, 1994). In this context, the two East Asian immigrant teachers in this chapter have responded to perceived value differences in ways which generally correspond to the amalgamation and appropriation approaches. Based on the questionnaire returns alone, it is understandably not clear the extent to which each of these two approaches have been adopted by Thomas and Xiaoming in their negotiation of the value differences. Both these approaches represent the blending of cultural values, albeit in different ways. The amalgamation approach involves the immigrant teacher adding certain Australian values to his/her personal value schema, while values associated with the home country continue to shape the teacher's worldview and disposition. Thus, in the light of Xiaoming's comments discussed earlier, if his practice in the Australian classroom features distinct periods of demonstrating (the Chinese cultural valuing of) 'beauty' (e.g. through teaching proof) and instances of working with contextualised, applications-based problems, it is likely he is amalgamating practices related to the two values in his practice. His conception of mathematics teaching would still be one which emphasises the beauty inherent in the structure and organisation of the discipline; that he includes applications problems as part of his classwork/homework/assessment may simply be a reflection of his valuing of reflecting the Australian culture in his professional practice.

On the other hand, an appropriation approach to negotiating difference in values involves the modification of personal value schemas as a result of incorporating new values into the schemas. The teacher values both the home and host countries' values to an extent which sees both these being integrated; in a way, the valuing of one demonstrates the valuing of the other as well. Take the same value difference mentioned in the last paragraph, for example. If Xiaoming's responsive approach is appropriative, it is likely that he would teach for the applications of mathematical concepts, and within these applications problems Xiaoming would highlight any inherent beauty rather than treating them as questions which students have to learn to answer simply to satisfy external assessment requirements. Thus, an appropriation approach would see Xiaoming creating for himself a professional practice

based on the Australian 'model', enriched by his Chinese cultural and pedagogical values.

While no generalisation may be made here with regards to any representative approaches East Asian immigrant teachers may tend to adopt, it is useful to note that these are examples of positive interaction of culturally-based values related to the mathematics education systems of East Asia and the West. That Xiaoming and Thomas remain relatively empowered in the Australian teaching service exemplifies the opportunities for constructive and meaningful interaction between aspects of the mathematics education systems in these two parts of the world.

At the same time, the sense of frustration and helplessness the two immigrant teachers experienced at times serves to remind us how these negotiation processes may be less than smooth sailing for the psyche/soul. Thomas' note that some students and their parents in Australia question him over 'inadequate' textbook use (because he did not rely on the textbook closely in his lessons) highlights the limitations confronting teachers beyond the immediate confines of their mathematics classrooms. In Thomas' words, "I may not be teaching these kids next year, but I hope that some of them would have captured what I feel to be important this year so that they bring it [sic] with them to their future mathematics study and future lives. It's hard to change the culture here, but hopefully this [students picking up his values] will be something more permanent".

Cultures transform and 'move on' with time. As collective socio-cultural values undergo inevitable changes in level of relative emphases, cultures evolve in form and expression. It is helpful to remind ourselves that Thomas and Xiaoming's description of the Singapore and Chinese cultures respectively were based on their personal experiences as students and teachers in the relevant culture. Thus, the current-day mathematics educational scenes in Singapore and China are likely to be different from what is represented through the teachers' feedback in this chapter. The teachers' personal value schemas were shaped by home cultural values, and it was the perspectives offered by these value schemas through which Thomas and Xiaoming perceived differences in cultural valuing. Indeed, there is evidence in the first author's ongoing thesis research study that this phenomenon of 'culture freeze' is not affected by any ongoing knowledge of cultural change in the teachers' respective home countries, such as through communications and personal visits. It is worth noting, too, that development in home country's school mathematics curriculum often shows a tendency towards the embracing of relatively 'western' values, such as a greater integrated use of ICT in mathematics teaching, or the use of student group discussions in the pedagogical repertoire. Yet, these immigrant teachers would continue to

interpret perceived value differences from the perspectives afforded by their very own knowledge of home cultural values.

6. CONCLUSION

This exploratory survey of two East Asian immigrant teachers has identified several similarities and differences in the school mathematics education systems in East Asia and in Australia as seen by these teachers. At the same time, it has also highlighted several teacher perceived value differences which reinforce Hofstede"s (1997) five universal value dimensions. There is also indication that teacher readiness and ability to blend the perceived values in difference may lead to the evolution of more effective mathematics teaching practices which incorporate meaningful and relevant values of different cultures, and which lead to successful professional socialisation experiences of immigrant teachers of mathematics. The former outcome is clearly desirable as Australia, having achieved reasonably well in school mathematics in international comparative studies such as the Third International Mathematics and Science Study (TIMSS) (e.g. Lokan & Greenwood, 2001) and Programme for International Student Assessment (PISA) (Organisation for Economic Co-operation and Development, 2001), looks to further improve its school mathematics education system so that the Australian workforce is more able to compete with leading knowledge and innovative economies occupying top spots in these international comparative studies. The significance of the second outcome is best understood against a looming shortage of qualified teachers of mathematics in Australian schools, due to a decreasing pool of mathematics graduates and to an ageing teaching workforce (Australian Education Union, 2001). A systemic failure to support the professional socialisation experience of immigrant teachers more generally, and indeed all teachers in transition, represents costly loss/ wastage of human capital in the society in general, and in the teaching service in particular. While the transition of these teachers across geo-political borders may be a relatively easy trip at the physical level, the adaptation of their spiritual/affective soul to the new, Australian professional culture may be an expedition fraught with uncertainty and even hostility. A collective, systematic and informed approach to scaffolding this expedition for individual immigrant teachers will not only benefit these 'new' professionals individually, but will also be a worthwhile, long-sighted investment in the intellectual future of the society!

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