The influence of parents' culture on students' choice of mathematics study in senior years

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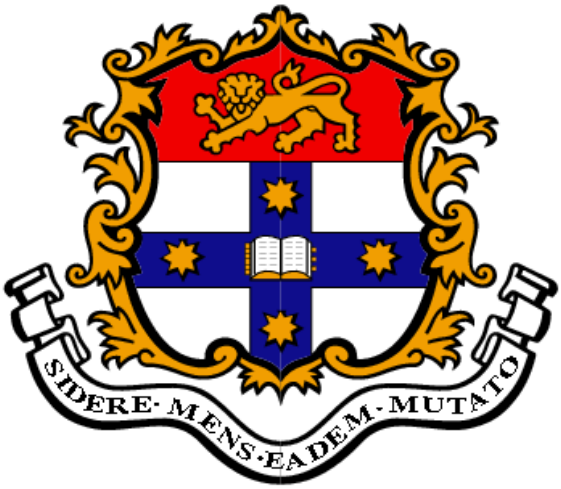

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ABSTRACT

An extensive body of research exists regarding the factors that influence students' decisions to study mathematics in senior years. Additionally, there is a significant body of research concerning student enrolments into mathematics courses and the trends and patterns that emerge as a result. However, little research has been performed concerning the influence of parents' culture on students' decisions to study mathematics, and in particular higher-level mathematics. This research explores and considers students' cultural backgrounds and the factors that affect students' mathematics choices and examines how this information can provide insight for principals, teachers schools and educational systems in encouraging and promoting mathematics education in New South Wales and abroad.

An interpretative research paradigm is used to investigate the factors and influences affecting students' decisions to study mathematics in senior years. This research is an exploratory investigation that provides a rich description of parental influences in one context. Questionnaires and two focus group meeting were conducted and analysed based on the major themes that emerged.

While only a small-scale study, the results of the research indicate that students cultural backgrounds differ and can affect students' influences to study mathematics in senior years. Furthermore, students from different cultural backgrounds are influenced differently based upon parental experiences, interests in mathematics and cultural views and attitudes of mathematics education. Additionally, this research indicates that students who are studying higher-level mathematics are influenced differently as compared to students who are studying lower-level mathematics or chose not to study mathematics at all. Furthermore, the findings highlight a number of areas for further exploration including the differences between students' perceptions and parental beliefs about mathematics learning.

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1 INTRODUCTION

Concerns are currently being expressed about Australia's capacity to produce a critical mass of young people with the requisite mathematical background and skills to pursue careers in Science, Technology, Engineering and Mathematics (STEM) to maintain and enhance this nation's competitiveness. These concerns permeate all levels of learning and skill acquisition, with programs to assess mathematical achievement of primary and early secondary students regularly identifying areas that require concerted action (McPhan, Morony, Pegg, Cooksey, & Lynch, 2008). In the post-compulsory years of schooling, there is a worrying trend with enrolments in higher-level courses declining and enrolments in elementary or terminating mathematics courses increasing (Barrington, 2006). This trend is not an encouraging basis from which to improve the percentage of university graduates from mathematics rich courses that lead into STEM careers.

In senior secondary school, students choose to study mathematics for a range of reasons. McPhan et al. (2008) identified five main groups of factors that influence students' decisions about continuing the study of mathematics namely aspirations, engagment with the curriculum, performance, subject image and family and peers. One factor which seems to have a significant influence particularly for some ethnic groups, is that of families and, in particular, parents. Parents play an important role in influencing students' mathematics learning, but parents from different cultural backgrounds and in different societies may influence their students' learning differently. In particular, perceptions of the nature, role and importance of mathematics in the education of students may differ between cultural groups. Cao, Bishop and Forgasz (2006) explored the perceived parental influence on mathematics learning in Australia and China. The research showed that students in China had stronger perceived parental encouragement and higher perceived parental educational expectation than students in Australia.

Australian society is composed of a wide range of cultures, that is, groups of people who share similar ethnic backgrounds, language, ideologies, attitudes, values and customs concerning rules of interpersonal behaviour. Due to Australia's multicultural society, there is a need to study and research the influence of culture on education. More specifically, there is a need to look at the influence of culture on students' choice of subjects in Years 11 and 12. This means that there is scope here for a great deal more research that**:**

- is based on empirical data of students' subject choices as influenced by their cultural backgrounds;
- explores parental influences on mathematics subject choice among different groups of students.

In addition Bishop's (1993) earlier research into the parental influence on students' mathematical learning has produced some important points to consider. He writes, "If the collective parental and adult memory of school mathematics is in fact a largely negative one, this memory can easily be transmitted as a negative image to the next generation, thereby influencing the mathematical expectation of children, their motivation for studying mathematics and their predisposition for continuing, or not, to study the subject." This view calls for a need to look into these influencing factors and whether they pose a threat to students choosing mathematics in higher levels of schooling.

This study examines the influences of parents from 3 cultural groups (Australian, Asian and Middle Eastern cultures) on students' decisions about mathematics' study in the post-compulsory years. In particular, a case study of one school in NSW, is used to answer the following research questions.

1. What factors influence students' choice of level of study in mathematics in Year 11 including Mathematics Extension 1, Mathematics, or General Mathematics; and in Year 12 including Mathematics Extension 2?
2. a) What role does parents' culture play in students' choice at each of the 4 levels of mathematics in Year 11 and Year 12?

   b) Is there a difference between parents' influence on students' choice of mathematics level of the three cultures – Asian, Middle Eastern and Australian culture?

2 LITERATURE REVIEW

The review of the literature that follows has been organised into four main sections. The first provides an overview of the various background reports in relation to the study of post-compulsory Mathematics in Australian Schools. The second section discusses the various influences which have been identified as impacting on students' decisions to continue learning mathematics in the post compulsory years of schooling. This section has been divided into sub-sections according to the factors identified in the report *Maths? Why Not?* (McPhan et al., 2008) These sub-sections are;

- aspirations;
- engagement with the curriculum;
- performance and ability
- subject image;
- family and Peers

The third section looks at the study of parents' culture on subject choices with a specific emphasis on mathematics subjects. These sections are followed by a summary of the main ideas and suggestions for continued investigation leading to the research questions proposed for this study.

2.1 The study of post-compulsory Mathematics in Australia

2.1.1 A university perspective

There is a current need to improve school mathematics in order to increase the number of students studying mathematics at university and to improve the percentage of university graduates with a mathematics or statistics major. In 2003, the *OECD Education report* indicated that only 0.4% of Australian university students graduated with qualifications in mathematics or statistics, compared with an OECD average of 1% (McPhan, et al., 2008; Australian Academy of Science (AAS), 2006). Table 2.1

shows the enrolment figures for science and technology courses in Australia from 1989-2002. There is a declining trend in enrolments in the mathematical sciences when compared with other degree courses.

Table 2.1

Australian Enrolments 1989 – 2002 in Science & Information Technology Courses, by Field, All Students, All degrees (Adapted from Dobson, 2003)

Course Group	Growth 1989 – 2002						
	1989	1993	1997	2001	2002	No.	%
General/Other Sciences Courses	22554	32646	31293	32112	33161	10607	47.0
Life Sciences	15698	20488	28196	23896	25126	9428	60.1
Mathematical Sciences	4045	4590	4086	2703	2787	-1258	-31.1
Physical Sciences	6378	8048	8264	6074	5634	-744	-11.7
All Sciences Courses	48675	65772	71839	64758	66708	18033	37.0
IT Courses	13897	21004	27991	56474	61446	47549	342.2
Science & I/T	62572	86776	99830	121232	128154	65582	104.8

If the course enrolment patterns outlined above present a bleak picture for the study of mathematics at Australian universities, there is an urgent need to investigate reasons underlying this decline and look at possible ways to improve and combat the drop in enrolments for mathematical and science related courses in university (Chinnappan, 2007). It is possible that the way mathematics is taught in secondary school may be influencing students' decisions about continuing their study of mathematics at university.

2.1.2 A school perspective

Participation in mathematics courses in Australian schools has been studied closely over recent years. The trends from these studies have indicated a declining rate in the number of students opting to study either advanced or intermediate mathematics in senior years, while elementary mathematics has seen an

upward trend as fewer students are choosing not to study higher-level mathematics in Years 11 and 12. Table 2.2 details these trends from 1995 to 2004 as percentages of Year 12 students across Australian schools.

Table 2.2

Australian Year 12 Student enrolments as percentages of Year 12 students enrolled in a math course (Adapted from Barrington, 2006, p.3)

Year	Advanced Mathematics students % of Yr 12	Intermediate Mathematics students % of Yr 12	Elementary Mathematics students % of Yr 12 estimated	Total Aust. Mathematics students % of Yr 12 estimated
1995	14.1	27.2	37	78
1996	13.5	26.9	37	78
1997	13.5	27.1	39	79
1998	12.7	26.1	39	78
1999	12.3	25.1	41	79
2000	11.9	25.0	47	83
2001	11.3	24.2	45	81
2002	11.1	23.4	46	80
2003	11.8	23.5	47	82
2004	11.7	22.6	46	80

It is evident that the rates of students enrolling into advanced or intermediate mathematics courses have been declining, while students choosing to study elementary mathematics are on the rise (McPhan et al., 2008; Chinnapan 2007). This is particularly worrying when Australia's 15-year olds perform above the OECD average on assessments of mathematical literacy. In contrast to the above indications of concern, and in comparison to the rest of the world, Australia performs considerably well on the mathematical literacy (Chinnappan, 2007). For some reason, capable Australian students are choosing not to continue the study of advanced mathematics in the post-compulsory years.

As this study will take place in the NSW context, the classification used by Barrington (2006) determined advanced mathematics courses in NSW are *Mathematics Extension 1* and *Mathematics Extension 2* for

students in Year 12. The intermediate mathematics course is currently called *2 Unit Mathematics*. The elementary mathematics course is the *General Mathematics* course, which the majority of NSW students are enrolling into. In New South Wales, Barrington (2006) suggests there is a steady number of enrolments into advanced mathematics courses, namely *Mathematics Extension 1* and *Mathematics Extension 2*. However, as Table 2.3 indicates, students enrolling into advanced mathematics courses during the period from 1995 – 2004 show a general decline in enrolment trends. Furthermore, Intermediate mathematics is of greater concern as enrolments suffered a steep decline (Table 2.4). Universities typically recommend a minimum of 2 Unit Mathematics for students studying science, business or engineering related courses.

Table 2.3

NSW Students studying advanced mathematics courses during 1995 – 2004 in NSW (Adapted from Barrington, 2006, p.6)

Year	Total number of STUDENTS in Year 12 Advanced Mathematics	Total STUDENTS in Year 12	% of Year 12 STUDENTS taking Advanced Mathematics	Total population State or Territory	Year 12 Advanced STUDENTS per 10,000 population
1995	11395	60181	18.9	6126981	18.6
1996	10599	61638	17.2	6204728	17.1
1997	10025	63038	15.9	6276961	16.0
1998	9941	65311	15.2	6339071	15.7
1999	9606	65909	14.6	6411370	15.0
2000	9476	62415	15.2	6486213	14.6
2001	8794	62751	14.0	6575217	13.4
2002	9153	64805	14.1	6682053	13.8
2003	10200	65311	15.6	6682053	15.3
2004	9959	66279	15.0	6731295	14.8

Table 2.4

NSW Students studying intermediate mathematics courses during 1995-2004 in NSW (Adapted from Barrington, 2006, p.10)

Year	STUDENTS in Intermediate Maths but not in Advanced Mathematics	Total STUDENTS in Year 12	% of Year 12 STUDENTS in Intermediate Maths not in Adv Maths	Total population of State or Territory	Year 12 Intermediate STUDENTS per 10,000 population
1995	18040	60181	30.0	6126981	29.4
1996	16506	61638	26.8	6204728	26.6
1997	16196	63038	25.7	6276961	25.8
1998	15949	65311	24.4	6339071	25.2
1999	15680	65909	23.8	6411370	24.5
2000	15230	62415	24.4	6486213	23.5
2001	14585	62751	23.2	657217	22.2
2002	13948	64805	21.5	6640355	21.0
2003	14270	65311	21.8	6682053	21.4
2004	13306	66279	20.1	6731295	19.8

In the UK, Smith (2004, p.4) cites a "lack of awareness of the importance of mathematical skills for future career options and advancement" as a possible factor for the decline in mathematical enrolments at post-compulsory schooling. The trends and patterns that exist both in Australia and aboard, raises some important questions in examining and assessing the factors that affect students' decisions to study advanced or intermediate level mathematics courses.

2.2 Influencing factors on students' subject choices in Mathematics

The data in section 2.1 about Australian enrolments into intermediate or advanced level mathematics courses raises a number of key issues concerning the reasons for students' decisions to enrol into these courses. McPhan et al., (2008) outline five key areas of influence upon students' decision to study higher-level mathematics:

- aspirations
- engagement with the curriculum
- performance and ability
- subject image
- family and peers

For the purposes of this study, only four of these factors that relate directly to this study will be discussed. The following sections provide a brief summary of the impact of these influences on students' subject choices in mathematics.

2.2.1 Aspirations

The mathematics courses studied in senior secondary school have a significant influence on the educational and career options available to students. Students with higher levels of earlier school achievement as well as those with aspirations for future education, are more likely than other students to be enrolled into advanced mathematics courses (Fullarton, Walker, Ainley, & Hillman, 2003). However, it is worrying that for most students, the relationship between mathematics, tertiary study and career options remains unimportant and poorly understood (Chinnappan, 2007). Students with the potential to study advanced mathematics courses but choose not to, appear to have limited knowledge about future career options and a career in mathematics is perceived as not being very appealing when compared with other higher earning income careers (Chinnappan, 2007). Futhermore, it seems that "Australian universities are lowering mathematics prerequistes and this is undermining enrolments in high school

mathematics" (AAS, 2006, p.9) while consequently offering bridging courses for first year students to prepare them for their degree (Chinnappan, 2007).

In the report *Maths?Why Not?* McPhan et al., (2008) surveyed teachers, career professionals and students to gain an undertstanding of the influences and perceptions on students' decisions in choosing to study advanced or intermediate mathematics courses. The survey administered to teachers and career professionals was categorised into four major influences including school influences, sources of advice influences, individual influences and other areas of influences. Of the 399 school teachers, 240 teachers were from a metropolitan area, while of the 120 career professionals, 81 were from a metropolitan.

It is worth noting that of all the influences shown above, parental aspirations and expectations as well as an understanding of career paths were rated, among teachers, as the highest two of other influences impacting on students' decision to study advanced level mathematics courses (see Figure 2.1). Indeed, teachers' ratings for *very influential* and *extremely influential* accounted for 66% of the responses for parental aspirations and expectations.

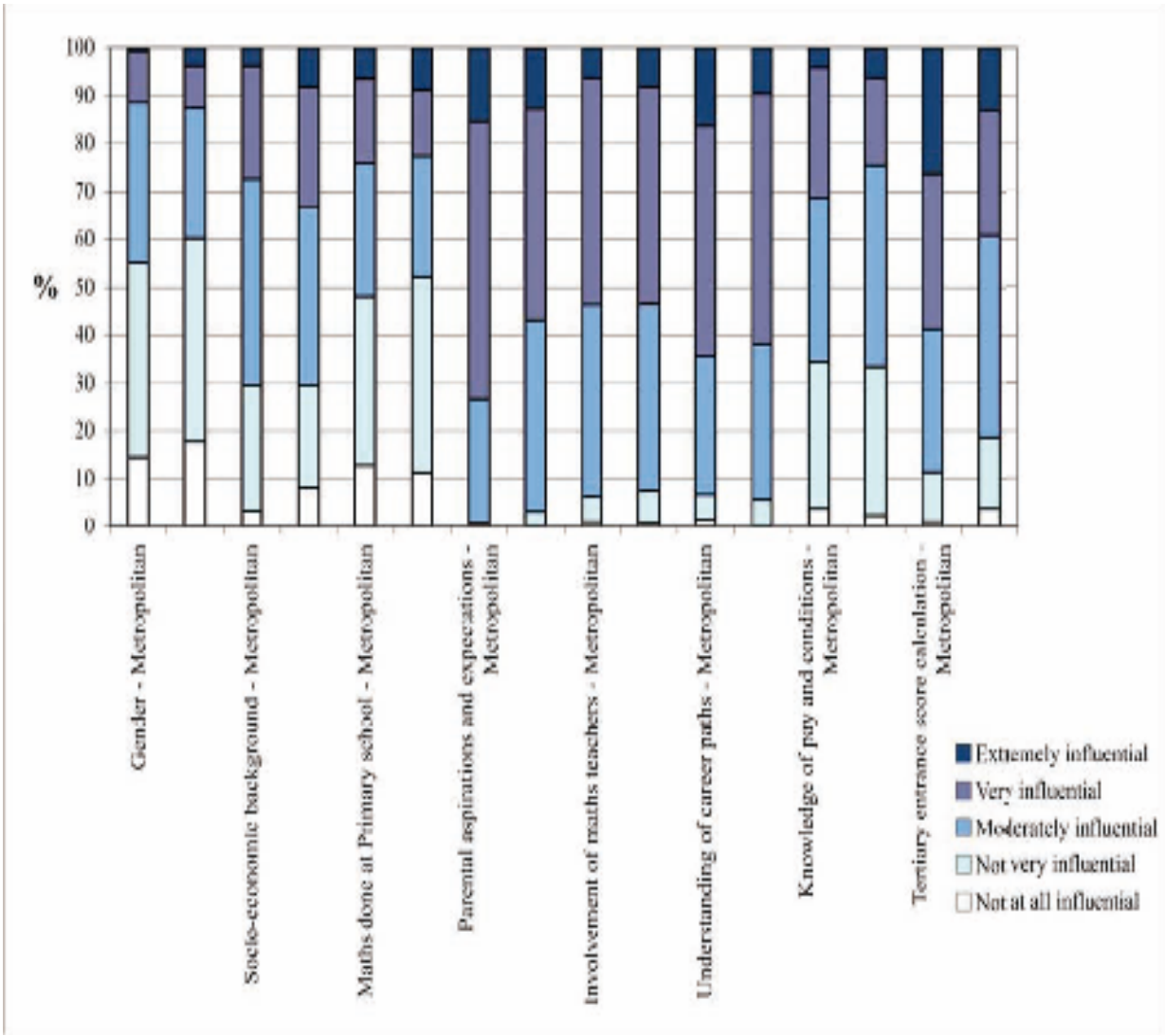

Figure 2.1 Teachers' perceptions of other influences on Students' Decisions in choosing to study advanced mathematics courses (Adapted from McPhan et al., p.32).

A similar survey was administered to students in Years 10 and 11 with 89% of students responding to the survey. The survey contained 19 questions about influences on students' choice of mathematics. Regardless of choice, 90% of students indicated that their decisions met with parental approval (McPhan et al., 2008). The survey also included opportunities for students to provide extended comments about the advantages and disadvantages of doing higher-level mathematics courses. These comments were analysed for common themes and are summarised in Table 2.5. The comments reinforced the post secondary importance of mathematics in leading to further study and as a basis for a specific career.

Students also recognised the value of the knowledge and problem-solving skills acquired through doing a more challenging course and that the benefits come at a price, in terms of effort and time allocation.

Table 2.5

Students' Views of the Advantages and Disadvantages in Doing Higher-level Mathematics (Adapted from McPhan et al., 2008, p.75)

Question 38: Advantages of Doing Higher-level Mathematics		Question 39: Disadvantages of Doing Higher-level mathematics	
Theme	%	Theme	%
Greater understanding and knowledge acquired	29.1	Workload and time required	36.1
Career relevance	27.3	Difficulty of the subject	32.4
UAI and university course requirements	19.1	Grades obtained	4.5
Keeps options open	6.4	Previous preparation and support available	3.6
Support associated with higher-level mathematics	2.7	Lack of relevance	3.6
Nil response; not doing higher-level mathematics	15.4	Nil response: not doing higher-level	19.8

2.2.2 Engagement with the Curriculum

Engaging students with the curriculum is an essential aspect in influencing students to continuing studying mathematics in senior years. McPhan et al. (2008) highlight four general areas relating to engaging students with the curriculum including the nature of mathematics, the support needed, the relationships students establish as they learn mathematics, and the learning experiences provided within the curriculum.

For the nature of mathematics among high achieving students, the notion that by good luck and memorisation of facts and formulae leads to success in mathematics was dismissed (McPhan et al.,2008). McPhan et al. (2008) provide a number of significant responses by students in relation to curriculum engagement. Firstly, student responses to individual and school influences gave an indication

of the importance of motivation, past experiences, teacher advice and subject availability as driving factors for students' choices (See Figures 2.2 and 2.3).

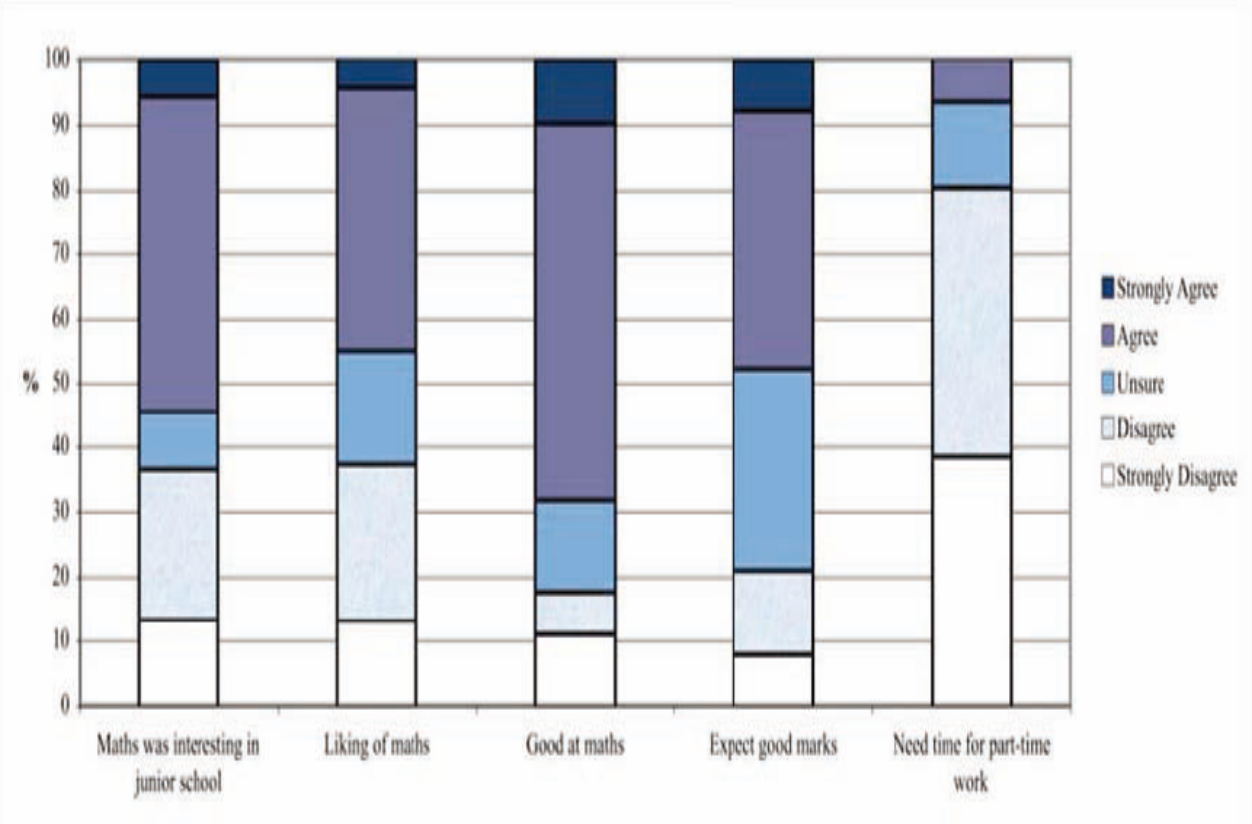

Figure 2.2 Student Response to Individual Influences on their Choice of Mathematics Courses (Adapted from McPhan et al., 2008, p.73)

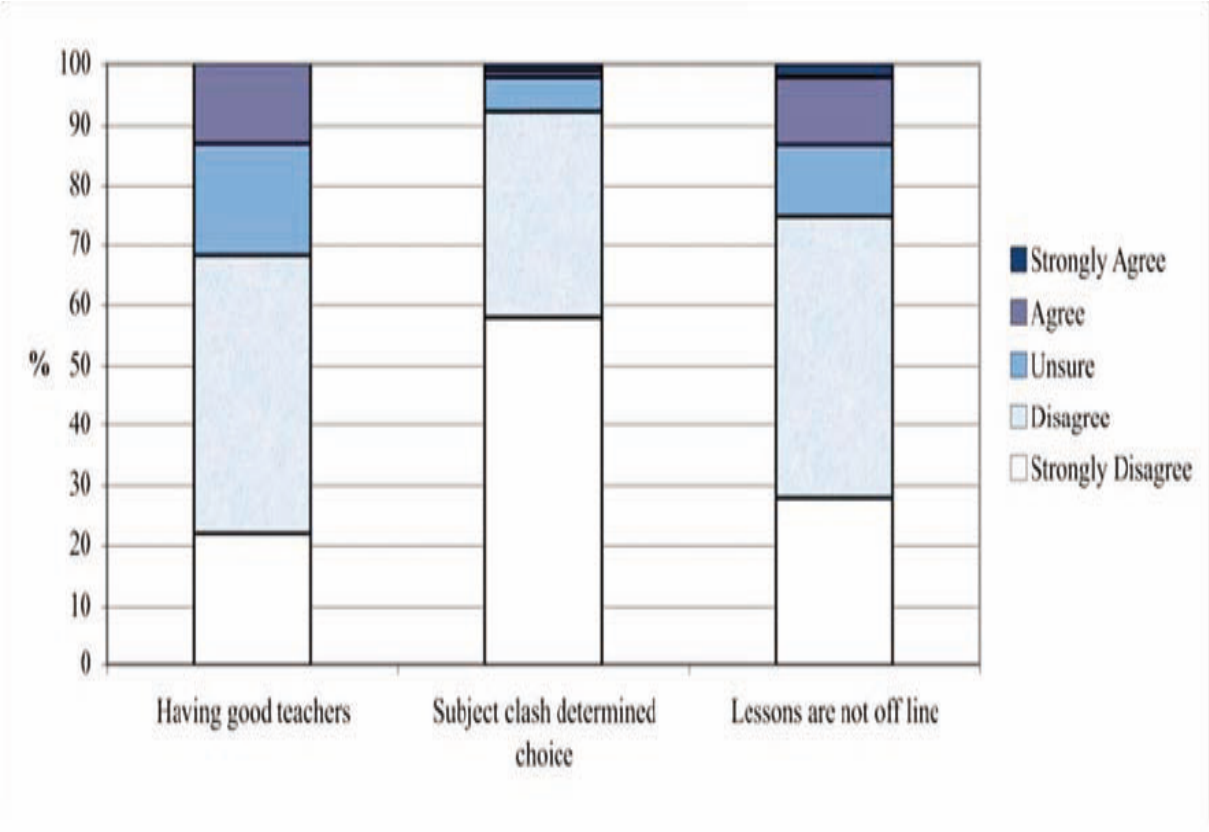

Figure 2.3 Students' Responses to School Influences on their Choice of Mathematics Courses (Adapted from McPhan et al., 2008, p.73)

Secondly, the support needed to achieve good results in mathematics did not depend on the widespread use of computers in mathematics. A Victorian study in which Year 11 students were surveyed for their ideas about computer use in mathematics, indicates that only a minority of students believed that computers had assisted their understanding in mathematics (Forgasz, 2004).

Thirdly, teachers play a significant role in engaging students in learning mathematics and hence influencing students' decisions in studying mathematics in Years 11 and 12 by establishing relationships with students that foster their mathematics learning (McPhan et al., 2008). The role of teachers in building and maintaining student relationships allows for an established learning environment to take place where students are enjoying and engaging in learning mathematics. Teachers who maintain good relationships with students have a positive effect on students' self-perceived achievement in mathematics (Marks, 1998). Students respond positively to qualified teachers that stimulate their thinking, making mathematics

interesting and engaging. The image and perception that teachers portray on mathematics is a significant influence in impacting on students' decision for choosing to study or not to study mathematics.

Fourthly, the learning experiences provided within the curriculum in previous years of schooling provide a platform for enrolment into advanced or intermediate level mathematics courses in senior years. The mathematics curriculum from Year 7 to Year 10 is believed to be more practical in application than advanced or intermediate mathematics courses in senior years (McPhan et al., 2008; Brinksworth & Truran, 1998). This may account for more students in NSW choosing to continue studying the more practical mathematics offered in the *General Mathematics* courses rather than the calculus-based mathematics courses of *2 Unit Mathematics* and *Mathematics Extension 1*. However, the performance of students in junior years of schooling can also influence on students choosing to study higher-level mathematics.

2.2.3 Performance and ability

Performance is another key influence in understanding the reasons and factors that affect students' decisions to study advanced and intermediate mathematics courses. Students who are struggling with mathematics in earlier years of high school are more likely to study *General Mathematics* while students who show high performance levels in Year 9 and 10 are most likely to enrol into advanced and intermediate mathematics courses in Year 11. Based on Year 9 achievements in literacy and numeracy identified in the various *ACER Longitudinal Surveys of Australian Youth* (Fullarton & Ainley, 2000), the majority of students (75%) enrolled in advanced mathematics courses are drawn from the top two quartiles of achievement (Fullarton et al., 2003). Later studies have also shown that students' level of success in middle and early years of schooling regarding participation rates can influence educational intentions and subsequent participation (Khoo & Ainley, 2005).

2.2.4 Family and Peers

The influence of parents, friends and different cultural groups appears to be significant on students choosing to study mathematics in senior years. The views and perceptions of mathematics within the home provide a strong indicator as to students pursue further studies in mathematics in senior years of school. In addition McPhan et al., (2008) argue that parents' occupation and education achievements have an influence on students' participation in mathematics courses. Since the influence of parents' culture is a focus for this study, the underlining issues of the influence of family and peers will be discussed in the next section.

2.3 Parents' cultural influences on subject choice

The influence of parents' culture on students' decisions to study mathematics in the post compulsory years of schooling is examined in this study by investigating the influence of parents from three prominent cultural groups. In support of a focus on diversity in culture, Clarke, Shimizu, Ulep, Gallos, Sethole, Adler and Vithal (2006, p.354) state:

> "Australia, in particular, is culturally plural. In the south-eastern suburbs of Melbourne, a class of twenty five children can include over twenty distinct ethnic backgrounds. This raises the question of the interaction between home culture and school system, and suggests that the identification of a nation with a single culture may be appropriate only rarely in a world that is increasingly internationally mobile."

Such diversity is also evident in many schools in the Sydney region of NSW where this study will be conducted. This section defines and discusses culture and learning mathematics, as well as considering parents' culture in a range of cultural groups.

2.3.1 What is culture?

The term culture has been defined in various ways. In relation to education, culture is not static, but changes according to socio-historical circumstances (Welch, 2007). In understanding the role of culture in education, it is important to be able to define what culture is and what is meant by culture in mathematics education. Leung, Graf and Lopez-Real, (2006) states that,

> "Culture refers essentially to values and beliefs, especially those values and beliefs which are related to education, mathematics or mathematics education."

2.3.2 Culture and Learning Mathematics

The culture and learning of mathematics is of significant importance especially with rapid development in information and communication technologies. Leung et al., (2006) argue that "increasing globalisation is encouraging the assumption of universalism in mathematics education." However, there is a concern that the globalisation processes are producing reactions from mathematics educators in many countries of the eradication of regional and local differences in educational approach.

In the context of globalisation and education, there is a need to improve the quality of mathematics education by learning from different countries. Leung et al., (2006) relates the impact of cultural traditions to the teaching and learning of mathematics, by saying

> "The impact of cultural tradition is highly relevant to mathematics learning. Cultural traditions encompass a broad range of topics. It includes the perceived values of the individual and the society structures such as the relationship between parents and students, or the relationship between teachers and students."

2.3.3 Parents' Culture

Parents play an important role in influencing students' mathematics learning, but parents from different cultural backgrounds and in different societies may influence their students' learning differently. Cao, Bishop and Forgasz (2006) investigated the perceived parental influence on mathematics learning in Australia and China. The research showed that students in China had stronger perceived parental encouragement and higher perceived parental educational expectation than students' in Australia. The perceived parental influence of students from different home language backgrounds was also investigated. Students in China demonstrated stronger perceived parental encouragement and parental expectation than English speaking students and other language speaking students in Australia. They also demonstrated stronger perceived parental expectation than Chinese speaking students in Australia, and similar perceived parental encouragement.

A questionnaire was used by Fullarton and Ainley (2000) to examine the patterns of subject enrolments in Year 12 in Australian schools, and the relationships of those patterns to characteristics such as gender, socioeconomic background, and ethnic background, location of school, school system, and earlier school achievement. The research indicated that students of non-English backgrounds were more likely to do mathematics than students born of English backgrounds. For parental influence, students who had parents with a higher education tended to do higher levels of mathematics than students with lower education parents. Fullerton and Ainley (2000) determined the ethnic background of students as the parental birthplace rather than the language spoken at home. This is a convenient and useful way to determine parents' culture and is employed in this study.

2.3.4 Investigating Particular Cultures

For the purposes of this study it is vital to be able to distinguish and identify the three focus cultures. The three cultures – Asian, Middle Eastern and Australian cultures are the three largest cultural groups present in Sydney as shown in Table 2.6.

Table 2.6

Top ten community languages in Sydney, 2001 (Adapted from Welch, 2007, p.160)

Language Group in Sydney	Number of people in the community language
Arabic	142, 467
Cantonese	116, 384
Greek	83, 926
Italian	79, 683
Vietnamese	65, 923
Mandarin	63, 9716
Spanish	44, 672
Tagalog	40, 139
Korean	29, 538
Hindi	27, 283

In view of this comment and in the light of this study it is important that the particular cultures identified are not merely referred to in terms of geographic and political divisions. The following definitions for each of the three cultures are therefore "cultural demarcations" rather than geographic divisions (Leung, Graf, & Lopez-Real, 2006).

Asian Culture is that culture in which students' parental birthplace is China, Vietnam, Indonesia, Taiwan, Hong Kong, South Korea or India. In relation to mathematics education, Asian culture is very content oriented and examination focused. Large class sizes are the normal teaching practice and classroom teaching is usually conducted in a whole class setting (Leung et al., 2006). Middle Eastern Culture is that

culture in which students' parental birthplace is Egypt, Lebanon, Iraq, Kuwait and Algeria. Australian culture is that culture in which students' parental birthplace is Australia.

2.4 Research Questions

The proposed research questions for this study aim to address some of the concerns raised in the literature review and provide a platform in answering some of the emerging issues in students' choices of mathematics in senior years of schooling. There are two research questions:

1. What factors influence students' choice of level of study in mathematics in Year 11 including Mathematics Extension 1, Mathematics, or General Mathematics; and in Year 12 including Mathematics Extension 2?
2. a) What role does parents' culture play in students' choice at each of the 4 levels of mathematics in Year 11 and Year 12?

   b) Is there a difference between parents' influence on students' choice of mathematics level of the three cultures – Asian, Middle Eastern and Australian?

3 METHODOLOGY

An interpretative research paradigm is used to investigate the factors and influences affecting students' decisions to study mathematics in senior years (Cohen, Manion & Morrison, 2000). This research is an exploratory investigation that provides a rich description of parental influences in one context. To answer the research questions, a case study approach of one school is used. Data were collected from Year 10 and Year 11 students in a coeducational comprehensive high school with a high multicultural population. In addition to a questionnaire, two semi-structured focus group meetings were conducted with six students, three from Year 10 and three from Year 11. Focusing the research on the three cultures, with highest numbers of students in the school (Australian, Asian and Middle Eastern) allowed for a more detailed investigation into the issues related to the influences on students' decisions to study mathematics in Years 11 and 12.

3.1 Research Site and Participants

The research site was a comprehensive co-educational high school for Year 7 to Year 12 in the Sydney region. In the 2007 Annual Report, the school is described as a multicultural community which has, on average, greater than 60% of students having a language background other than English. The school is considered to be of diverse financial and economic backgrounds as outlined in the policy of the School Board. In 2007, 75% of students achieved above the benchmark for the Year 7 State Numeracy test. Furthermore, 20% of students achieved either a band five or six in the 2007 School Certificate test which was similar to the state average results. The percentage of students who gained entry into university was 45% compared with 30% of the general population.

As this study examines Year 10 and 11 students' subject choices in mathematics, it is important to consider current enrolments in the different **levels** of mathematics in Year 10 (see Table 3.1) and in the different **courses** for mathematics in Year 11 (see Table 3.2). Since the Year 10 classes are streamed,

these tables suggest that the top class of 30 students may choose either *Mathematics Extension 1* or *2 Unit Mathematics.* Furthermore, students in 10M2 would be deciding to study either *2 Unit Mathematics* or *General Mathematics*. In the Year 11 enrolments, the number of students studying General Mathematics was approximately 50% which is consistent with state average. These data provide background information relevant to this study and confirm this school is a typical comprehensive, coeducational high school in the Sydney region.

Table 3.1

Year 10 enrolments in mathematics classes in 2008

Mathematics Class	Stage 5 level	No. of students
10M1	5.3/5.2	30
10M2	5.3/5.2	30
10M3	5.2/5.1	22
10M4	5.2/5.1	14

Table 3.2

Year 11 enrolments in mathematics classes in 2008

Mathematics Class	Course	No. of students
11M1	Mathematics Extension 1	13
11M2	2 Unit Mathematics	18
11M3	General Mathematics	20
11M4	General Mathematics	17
No Maths	N/A	14

3.2 Research Methods

This study was conducted in two phases. This section outlines the design of the questionnaire administered to students and the focus group meetings that were conducted with six students chosen from the sample.

3.2.1 Questionnaire Design

The first phase of the study involved a questionnaire administered to all students in Year 10 (96 students) and Year 11 (82 students). The questionnaire consisted of three sections (see Appendix A). Part A was constructed using open-ended and dichotomous questions to gain information about year level, gender, country of birth, parental birthplace and language most frequently used by the participant and the participant's family. Question 7 used a rating scale technique to investigate the perceived parental interest in mathematics.

Part B used a mixture of dichotomous and multiple choice questions to determine mathematics courses studied in Year 11. Additional questions including course changes and any intentions of studying *Mathematics Extension 2* in Year 12 were also examined. In the report *Maths? Why Not?* McPhan et al., (2008) contained 19 questions in their student survey on the influences on students' choice of mathematics study. A similar Likert scale question was used in question 10 with a total of 17 parts adapted from McPhan et al., (2008) in the questionnaire. The question was designed in order to provide a range of responses to a given question (Cohen et al., 2000). This allowed students to rate the influences that affected their choice to study mathematics by stating if they strongly agree, agree, disagree or strongly disagree with each influence. Part B also identified students' intentions to go to university and if so what degree they were intending to study.

Part C contained questions 13 to 16 with question 13 adapted from McPhan et al., (2008) and sought students' perceptions of the most important attribute that is required for success in mathematics. Three open-ended questions were designed to gather information regarding the greatest influence on students' decisions to study mathematics, the importance of parents in influencing this decision and the perceived emphasis of specific cultural groups in affecting students' decision to study mathematics. The open-ended questions were carefully crafted to avoid leading questions, highbrow questions, complex questions, or questions that use negatives and double negatives (Cohen et al., 2000).

3.2.2 Focus Group Meeting Design

The second phase of the study involved two semi-structured focus group meetings. The first focus group meeting involved three Year 10 students, one from each of the three focus cultures. Similarly, the second focus group meeting involved three Year 11 students, one from each of the three focus cultures. The aim of each focus group was to obtain further insight into the cultural influences that affect students' decisions to study mathematics in post compulsory senior years. The design of the focus group meeting questions (see Appendix B) was based on a need to understand and gain further insight into the cultural influences of students' decisions to study mathematics. Questions were crafted from the open-ended questions so as to investigate the reasons and cultural values behind students' questionnaire responses.

3.2.3 Data Collection

This study received approval from the Higher Education Research Committee (HREC) of the University of Sydney (see Appendix C for approval letter and ethics documents).

Of the 178 students who received information sheets about the study and consent forms, 127 students (71%) completed and returned a copy of the questionnaire. Of those 127 students, 67 students were in

Year 10 and 60 students where in Year 11. This is a high response rate providing a useful data set for this study (Cohen et al., 2000).

The questionnaires were administered by the head teacher of mathematics to all students in Years 10 and 11. Students were given a brief outline of the research project and notified of the optional decision to include their name, if interested in being invited to take part in a focus group meeting. The questionnaire was completed and collected during the first 15 minutes of a mathematics lesson.

Each focus group meeting lasted for approximately 20 minutes, was audio-recorded, and transcribed so that the data could be analysed. The focus group meetings were semi-structured as the questions were used as a guide only. Transcripts have been provided in Appendix D. The participants for each focus group meeting were selected from those students who indicated they were willing to participate in a follow-up focus group. A summary of the focus group participants is presented in Table 3.3.

Table 3.3

Focus group participant summary of Year, Course Enrolment and cultural group classification

Focus Group No.	Participant	Year	2008/2009 Course Enrolment	Cultural group classification
1	Victor	10	Mathematics Extension 1	Asian
	Ben	10	Mathematics Extension 1	Middle Eastern
	Tania	10	Not Studying Mathematics	Australian
2	Lee	11	Mathematics Extension 1	Asian
	John	11	Mathematics Extension 1	Middle Eastern
	Kate	11	General Mathematics	Australian

3.3 Data Analysis

Data from each questionnaire was transferred to an Excel spreadsheet. Quantitative data was considered first, then qualitative data. Quantitative data collected through the questionnaires were analysed using summary statistics. The data was compared and contrasted by different criteria to effectively assess and analyse the collected data. Qualitative, open-ended responses from the questionnaires were analysed through considering common themes within the three cultures as well as looking at the main differences to identify any key issues. Hence, qualitative responses were reviewed and coded. Categories of responses were identified and entered onto an Excel spreadsheet as column headings.

Focus group meetings were analysed at two levels. First, initial themes established in the survey data were identified to give further insight into the cultural influences of students' decisions to study mathematics. Second, the data were re-read and further analysed for commonalities and differences among the three cultures. Reading and re-reading the transcripts for deeper analysis and looking for new themes was an essential part of the second layer of analysis. As new themes emerged, existing themes were expanded to allow the research to contain a more accurate representation of the data. The next chapter presents the findings from the questionnaire and discusses the major findings from both the questionnaire and the focus group meeting components according to emergent themes.

4 RESULTS AND DISCUSSION

To determine the influence of parents' culture on students' decisions to study mathematics in the post-compulsory years of school, a questionnaire and focus groups were used to collect data in one multi-cultural school setting.

This chapter presents and discusses the findings from 127 questionnaires and the two focus group meetings conducted among six students from Year 10 (67 respondents) and 11 (60 respondents) concerning the cultural influences of students' decisions to study mathematics. Initially background information is presented and then the data relevant to each research question are presented.

4.1 Background Information

This initial section establishes a 'snapshot' of background information including gender, where in Year 10 64% of students were male and in Year 11 42% of students male. The cultural group classification of students was determined by birthplace of the parents. In the small number of responses where students' parents were born in two different countries, the language spoken at home was used as the determining factor for the cultural group classification (see Table 4.1). The students who did not match one of the three cultural groups for this study were placed into a mixed cultural group. Students who had parents from countries other than the three focus cultures were placed into an 'other' category. This is important due the qualitative nature of the research and analysis.

Table 4.1

Classification of cultural group based on parental birthplace for students in Year 10 and 11

Cultural Group	Father's Birthplace	Mother's Birthplace	Student Classification
Australian	30%	26%	33%
Asian	32%	35%	31%
Middle Eastern	14%	14%	13%
Other	24%	25%	16%
Mixed Culture	-	-	7%

Question 7 of the questionnaire asked students to rate the level of interest their parents had for mathematics. Out of the 34 respondents who are studying (Year 11) or intending to study (Year 10) *Mathematics Extension 1*, more than 80% of students rated both their parents as either *interested* or *very interested* in mathematics. Furthermore, students either studying or opting to study *General Mathematics* showed that almost 40% of parents are either *not interested* in mathematics or *don't know* their parents level of interest. Of the 127 questionnaires received, it was clear that the percentage of student enrolments was consistent with the state averages and that the majority of students in Year 11 (approximately 50%) were choosing to study General Mathematics (See Table 4.2)

Table 4.2

Percentage of mathematics enrolments into Year 11

Mathematics Course	Intended enrolments from Year 10 (N=67)	Current enrolments in Year 11 (N=60)
General Mathematics	32%	52%
Mathematics	13%	23%
Mathematics Extension 1	34%	18%
Not studying Mathematics	21%	7%

4.2 Factors Influencing Students' Choice of Mathematics Study in Year 11

To answer the first research question, 17 of the 19 parts from the McPhan et al. (2008) study were used in the questionnaire to gauge students' level of agreement. In addition, further discussion was pursued in each of the focus group meetings.

4.2.1 Questionnaires

The questionnaires contained 18 responses including 17 parts in question 10 that allowed students to rate the influences that affected their decision to study mathematics. The ratings have been collated to give a clearer representation of the results (see Table 4.3).

Table 4.3

Year 10 and 11 students' responses to the influences that affect students' choices to study maths (N=110)

	Question 10: Influences that affected students' choices to study maths	Strongly Agree or Agree	Strongly Disagree or Disagree
A	I chose my maths subject because maths was interesting in Junior secondary school	47	63
B	I chose my maths subject because I like maths	54	56
C	I chose my maths subject because I am good at maths	64	46
D	I chose my maths subject because I will get the good teachers	9	101
E	I chose my maths subject because the one I wanted to do clashed with other subjects or VET courses on the timetable	6	104
F	I chose my maths subject because I think I will get good marks	68	42
G	I chose my maths subject because it will give the best score I can get in Year 12	55	55
H	I chose my maths subject because I need it for a job or course (Uni or Tafe) I want to do	75	35
I	I chose my maths subject because it was what my maths teacher suggested	24	86
J	I chose my maths subject because other teacher(s) in the school suggested that I do it	13	97
K	I chose my maths subject because the school's careers advisor suggested it	11	99
L	I chose my maths subject because of the information I got from careers websites, brochures and careers expos etc..	25	85
M	I chose my maths subject because it made my parents happy	54	56
N	I chose my maths subject because some of my friends will be in the same class	23	87
O	I chose my maths subject because older students advised me to	38	72
P	I chose my maths subject because my older brother(s)/sister(s) advised me to do it	28	82
Q	I chose my maths subject because I need to have time to do my part time job	3	107

This table indicates that the most significant influences affecting students' decisions to study mathematics were career or tertiary education reasons (75 responses, H), a belief in achieving good marks (68 responses, F) and being good in mathematics (64 responses, C). Based on the *strongly disagree and*

disagree ratings the influences that did not affect students' choices were able to be determined and analysed. Hence, the influences which did not affect choice were because of time needed to do a part-time job (107 responses, Q) a timetable clash (104 responses, E) and wanting a good teacher (101 responses, D). Figure 4.1 provides a visual representation of the results in Table 4.2.

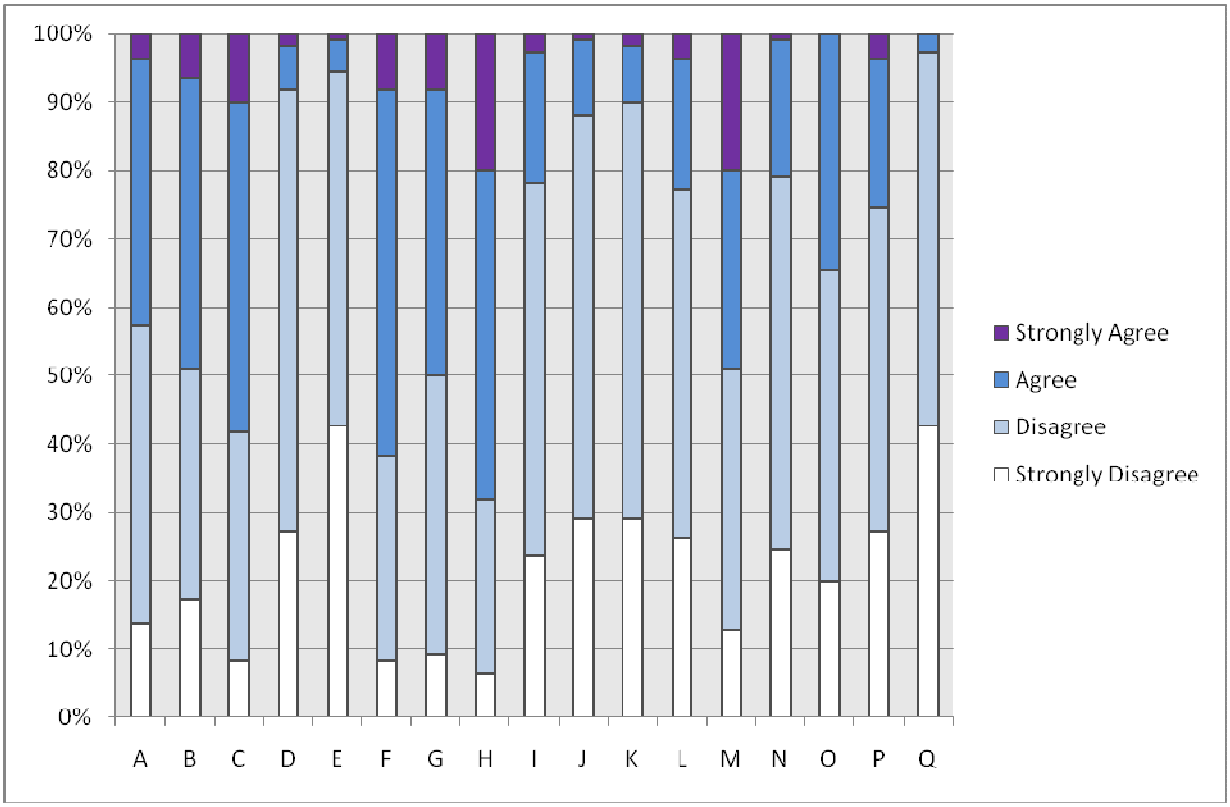

Figure 4.1 Overall student responses to the influences that affect students' choices to study maths

McPhan et al., (2008) reported similar findings with career and tertiary study as well as being good at maths being of similar influences. However, it is interesting to note that the influence to study mathematics based on making parents happy was not a significant factor in the *Maths? why not?* report. Hence, it is important to examine the influence to study mathematics based on making parents happy due to the closeness of the results collected. In order to understand this influence more closely, influence M has been further analysed according to student cultural groups (see Table 4.4). This table is significant in indicating that 63% of students did not choose to study mathematics based on making parents happy. On

the other hand 59% of Asian students stated that making parents happy was an influencing factor on their decision to study mathematics.

Table 4.4

Students' agreement to influence M in question 10 of the questionnaire

Cultural Group	Strongly Agree or Agree	Strongly Disagree or Disagree
Australian	37%	63%
Asian	59%	41%
Middle Eastern	50%	50%
Mixed Culture	50%	50%
Other	47%	53%

An open-ended question also sought information about influencing factors. Question 14 aimed to capture additional factors that otherwise might not have been identified in the rest of the questionnaire. Responses were read to identify themes and then coded accordingly. Table 4.6 presents the findings of this question in comparison with the McPhan et al. (2008) study who collated similar themes and findings. However, two additional themes emerged in this study.

Table 4.5

Influences in continuing to study mathematics into the senior school – this Study compared to the McPhan et al., (2008) results.

This Study		McPhan et al., (2008)	
Theme	%	Theme	%
Greater understanding and knowledge acquired	18	Greater understanding and knowledge acquired	29
Career relevance	13	Career relevance	27
UAI and university course requirements	17	UAI and university course requirements	19
Keeps options open	6	Keeps options open	6
Support associated with higher-level mathematics	6	Support associated with higher-level mathematics	3
Nil response; not doing higher-level mathematics	16	Nil response; not doing higher-level mathematics	16
Family and friends	22	N/A	
More HSC units needed to satisfy BOS requirements	2	N/A	

Of the two additional themes that emerged, *family and friends* was considered to be the most influential factor in continuing to study mathematics in senior years in this study. This would suggest that the culture, values and beliefs that exist among parents towards mathematics is related to students choice of mathematics study. Although the influence of family and friends was not seen as an emerging theme in the McPhan et al., (2008) survey, it is worth noting that McPhan et al. (2008) acknowledged through later focus groups that the influence of family and friends is relevant to students' decisions to study mathematics.

4.2.2 Focus Group Meeting

Each focus group provided further insight and depth into the influences that affected students' choice to study mathematics. The initial themes identified in the questionnaire (see Table 4.5) emerged in the focus group meetings with mathematical knowledge, career relevance, UAI and university course requirements being of important influences. However, the influence of parents and friends appeared to be the most significant influence among students of Asian and Middle Eastern backgrounds. These students commented on their influence on their choice to study mathematics and in particular *Mathematics Extension 1.* Typical comments included:

> I like maths to a certain extent. I like learning about maths in general. But when I choose Extension 1 it wasn't because of me ....it was my dad. He wanted me to choose it because he was good at maths in high school so he thinks that I will be automatically good at maths. Another reason is because he counts maths as one of the important subjects. He comes from this mind frame, i don't know its probably culture where maths and science are more important then history.....PDH PE and those type of subjects. I did not want to choose Extension 1 but my dad kind of forced it. [John, Middle Eastern Male]
>
> I find it was culture for me as well. ...there is a bit were it is good for UAI and scaling but mainly it is the Asian point of view.....you are not good at English.....maths is the way we go.....thats how we show what we are good at.....all the parents and cousins do all the maths and mainly because of the surrounding culture. [Lee, Asian Male]

A student from an Australian background commented on their influences by stating:

> Basically I thought it would be good to have a basic level of maths for future use....I was alright at maths in Year 10 but I wasn't spectacular at it....so I thought I would do something that I am ok at so I can do ok.....but not for anything other than have the knowledge of it. [Kate, Australian Female]

The factors influencing students' decisions to study mathematics in senior years is determined by a range of aspects including content knowledge, career and university relevance and family and friends. Students

who chose to study advanced or intermediate mathematics seem to be influenced more by family and friends and more specifically the culture of parents. The next section examines the influences of this parental culture on the influences to study senior mathematics.

4.3 Influences of Parents' Culture on Mathematics Study

To answer the second research question, open-ended questions from questionnaires were coded and analysed to provide information into the influences of parents' culture on mathematics study in senior years. In addition, further discussion was undertaken of the focus group meetings.

4.3.1 Questionnaires

In order to answer research question 2(a), it is important to be able to distinguish between the responses of students in relation to the course of mathematics study. Based upon the literature, students who chose advanced or intermediate mathematics are more likely to be influenced by their parents' culture. For example, the majority of students (71%) who enrolled into an advanced mathematics course (*Mathematics Extension 1*) were of Asian background. This would suggest that choosing an advanced mathematics course would involve stronger parental encouragement and higher parental expectations (Cao et al., 2006). McPhan et al. (2008) identify that parents and siblings are an influencing factor on students' decision to study mathematics. Quite similar to this study, they comment on the diversity of parental expectations and the encouragement received by students from parents as they make decisions about their choice of mathematics study.

Question 15 of the questionnaire sought to identify the role of parents' culture on students' choice to study mathematics at each of the four levels of mathematics in Year 11 and 12. The question provided insight into the different cultural expectations, beliefs and attitudes regarding mathematics. Table 4.7

summarises the data collected and analysed from the questionnaires where the majority of students (71%) studying *Mathematics Extension 1* indicated that parents influence were *important* or *very important* in their decision to study an advanced mathematics course.

Table 4.6

Percentage Level of importance of parental influences on students' decisions to study mathematics based on course studied

Course	Not important	Important	Very Important	Nil Response
General Mathematics	45%	25%	27%	3%
Mathematics	35%	35%	30%	0%
Mathematics Extension 1	27%	29%	41%	3%
Not studying Mathematics	50%	22%	0%	28%

Although this table helps to indicate the level of importance of parental influences based on the courses students are studying or intending to study, it is also worth investigate the level of importance of parental influences as perceived by each the cultural groups. Table 4.7 helps to represent this information that shows that there is a distinction between Asian and Middle Eastern culture as compared to Australian culture. It is interesting to note that 82% of Middle Eastern students commented on the influence of their parents as either *important* or *very important.*

Table 4.7

Percentage Level of importance of parental influences on students' decisions to study mathematics based on cultural groups

Cultural Group	Not important	Important	Very Important	Nil Response
Australian (N=42)	52%	24%	14%	10%
Asian (N=39)	26%	31%	38%	5%
Middle Eastern (N=17)	18%	53%	29%	0%
Other (N=20)	25%	35%	30%	10%
Mixed Culture (N=9)	33%	34%	33%	0%

Question 15 also provided some typical comments that helped to understand students' influences and their parents' role in deciding whether to study maths or not. Typical comments that were in line with the McPhan et al., (2008) study, included:

> I come from an Asian background and maths is taken very seriously by older parents. [Year 10, Asian Male]
>
> My parents are really big in maths and think it is important that everyone does it. [Year 11, Asian Male]
>
> My parents influence was very strong on my choice to do Mathematics Extension 1 when I only wanted to do 2 Unit Mathematics. [Year 11, Middle Eastern Male]
>
> My parents are Korean, they expect nothing less than Extension 1 Maths, I think I am the first Korean to do General Maths. [Year 10, Asian Male]
>
> My mum said pick anything you like. [Year 10, Australian Female]

These comments exemplify the cultural diversity that exists within Australia. Not only are there cultural differences between Australian and Asian culture, but it is evident that differences are prevalent within for example, Asian culture alone. This makes it difficult to accurately assess the students' cultural status in affecting their choice to study mathematics. However, there are obvious commonalities which show that

most Asian students stated that parents placed a strong emphasis on mathematics above other subjects. As a result, Asian students who decided not to study an advanced mathematics course, still acknowledged that it is expected that all Asian students enrol into at least *2 Unit Mathematics*.

Research question 2(b) was answered by determining and assessing the questionnaires to see if there are differences in parental influences between the three cultures – Asian, Middle Eastern and Australian. Question 16 gave insight into the perceived views of students on their cultural group's emphasis on choosing to study mathematics (see Table 4.8).

Table 4.8

Percentage of cultural group's perception on the cultural emphasis on choosing to study senior mathematics (Question 16)

Cultural Group	Yes	No	Unsure	Nil Response
Australian (N=42)	7%	76%	7%	10%
Asian (N=39)	74%	21%	2%	3%
Middle Eastern (N=17)	41%	53%	0%	6%
Other (N=20)	15%	80%	5%	0%
Mixed Culture (N=9)	11%	78%	11%	0%

This table indicates that 76% of Australian students who returned the questionnaire did not think that their culture had a strong emphasis on choosing to study mathematics. On the other hand 74% of Asian students stated that their cultural background placed a strong emphasis on mathematics and specifically in continuing further study in mathematics throughout the senior years of schooling. Question 16 also gave students an opportunity to express their attitudes and beliefs in regards to culture and mathematics learning. Some typical comments noted were:

Lebanese parents always try and push their kids to be well educated and at their best. [Year 10, Middle Eastern Male]

Yes, because every Asian does maths. [Year 11, Asian Male]

No, my background says do whatever, no one forces you to do anything or be anything your not. [Year 10, Australian Female]

No, not really. I am of a Australian background and do not feel pressured by my culture to study mathematics. [Year 10, Australian Female]

I'm Asian so yes. What type of Asian doesn't do maths? [Year 11, Asian Male]

Yes. A requirement to be an Asian is to do maths.
[Year 10, Middle Eastern Female]

Yes, because Arabic people see maths as very important.
[Year 11, Middle Eastern Male]

4.3.2 Focus Group Meetings

The focus group meetings were able to extend the knowledge gained from the questionnaire and to provide further insight into the influence of parents' culture on mathematics study. Based on the literature, parents from different cultural backgrounds and in different societies may influence their students' learning differently. Furthermore, the research has indicated that students of non-English backgrounds were more likely to do mathematics than students born in Australia (Fullarton & Ainley, 2000; Cao, Bishop, & Forgasz, 2006). Similar themes and ideas were developed and analysed from the focus group meetings that support the literature and the idea that parents culture has an influence on students' decisions to study mathematics.

Students from the three focus cultures shared their experiences, views and perceptions of mathematics education as seen and viewed in their specific cultural backgrounds. Students from the three cultural backgrounds also gave insight into the commonalities and differences that exist between parents influence on students' choice of mathematics. With the majority of comments coded into themes, Asian

and Middle Eastern cultures were similar in responses to the views and influences on mathematics study. Students, in particluar those studying *Mathematics Extension 1* from an Asian or Middle Eastern background, stated that if it weren't for parental influence their decision to study higher-level mathematics might have been harder or even different. For example, two students, commenting on whether their decision to study *Mathematics Extension 1* would have changed had their parents been less interested in mathematics, stated:

> I would not have done 3unit, I would have done 2unit. [John, Middle Eastern Male]

> My choice in choosing 3unit and 2unit would have been a lot harder. I would have tossed it a bit more....is it better for me to do 2unit or 3unit ....as John said....I could do really well in 2unit....I am a pretty lazy guy and you need to put a lot of time into 3unit...I would have put more time into other subjects. [Lee, Asian Male]

By contrast, the focus groups seemed to suggest that Australian culture allowed students to choose subjects and more specifically the mathematics course that will result in achieving the best marks possible. Australian culture also emphasised that mathematics was not given a higher priority than other subjects as compared with Asian and Middle Eastern cultures who saw mathematics as more important than subjects (Cao et al., 2006; Fullarton & Ainley, 2000). An Australian student commenting on their decision to study *General Mathematics,* stated:

> That's what it is for me.....its not really my parents culture that is pushing me.....its what I want....I could chose what I think I can be best at rather than being told what I should do. [Kate, Australian Female]

Fullerton and Ainley (2000) identified that for parental influence, students who had parents with a higher education tended to do higher levels of mathematics than students with lower education parents. Although parent education was not examined in this study, the focus groups acknowledged that students studying Mathematics Extension, mostly from Asian and Middle eastern cultures, agreed that parents previous education and experiences was significant in the parental influence to study mathematics.

5 CONCLUSION AND IMPLICATIONS

The major themes that emerged from this research data investigated the influences on students' decisions to study mathematics and the role of parents' culture in affecting this decision. This provided information that was aimed at answering the research questions for this study. The research questions were answered by analysing the data collected from questionnaires and focus group meetings. A number of findings emerged from this study that provide helpful insight into previous research and areas that need to be investigated in the future. It is important to note that these findings cannot be generalised to all students or cultural groups but add to current research and highlight areas for further exploration. These findings have been discussed above and are summarised in this section.

The findings presented in this study provide principals, teachers, schools and educational systems with some key ideas for the influences that affect students' decions to study mathematics. Australia is a diverse and multicultural society with many commonalities and differences surrounding the different cultural groups that exist. This research has offered some interesting and significant findings that provide insights into this area of research. In addition, understanding the factors that influence students' choices allow for university institutions to combat the decline in trends of universty graduates with a mathematics major. Also, In the context of schools, teachers and principals are made more aware of the cultural influences or pressures that exist within homes of different cultural families and societies. For example, an Australian student might be gifted and talented to undertake an advanced mathematics course, but is lacking support or encouragement from parents, who fail to see the relevance and importance of such study. On the other hand, students from an Asian or Middle Eastern background might feel pressured by parents to study a course that they are academically not able to cope with.

McPhan et al. (2008) reported similar findings to this study. However, parental cultural influence was not as signifiant in the McPhan et. (2008) study. This could be due to a criticism in that students who volunteered for the study were the students of the teachers interviewed and not a random sample from a specific school context. Hence, this suggests the findings of this study are well suited to gaining an overall perception of students in the general population.

The limitations of this research, suggest that further investigation is needed in order to explore the above findings in greater depth. In order to extend the findings of this research, a number of factors and issues would need to be addressed in future research. Firstly, the participants in this study represented a variety of contexts and hence, a larger cross section of participants from a wide variety of schools would be needed in future studies. By using a larger number of schools, results would become more accurate and would provide a better indication of perceptions in the general population. This would in turn increase the reliability of the research data.

Since students' culture is a sensitive issue, this research attempted to gain insight into students' understandings in a non-confronting manner. However, by relying on students own reporting of cultures and cultural influences it is difficult to determine what they do and do not understand. Furthermore, culture presents schools with a range of issues to which teachers, principals and parents must overcome. Leung et al., (2006) provides an implication for Australian school systems. He argues,

> "The challenge for school systems in countries such as Australia....is to accommodate and cater for multiplicity of cultural backgrounds."

Future research in this area may attempt to include parental involvement and more direct lines of questioning. This study could have been improved by employing measures to gain perceptions of teachers and more specifically parents. Parents have experiences and cultural heritage that can be useful in affirming students' responses to their specific cultural group. In order to support the findings outlined

above surveys and interviews can be conducted between students' parents that would help explore the cultural influences from the perception of parents.

Although this research indicates a number of findings relating to the cultural influences affecting students' decisions to study mathematics and its application in the classroom, further research would need to be conducted in order to validate the outcomes of this study. This research would need to be adjusted according to the suggestions outlined above. Further research into the area of the cultural influences on students' mathematics choices and its impact in the classroom would be beneficial.

REFERENCES

Australian Academy of Science (AAS). (2006). *Mathematics and Statistics: Critical Skills for Australia's Future.* Retrieved August 2, 2008, from The National Strategic Review for Mathematical Sciences Research in Australia: www.review.ms.unimelb.edu.au/Report.html

Barrington, F. (2006). *Participation in Year 12 mathematics across Australia 1995-2004.* ICE-EM Publications in Education No 2: Australian Mathematics Sciences Institute.

Bishop, A. J. (2000). *Critical Challenges in Researching Cultural Issues in Mathematics Learning.* Melbourne: Monash University.

Bishop, A. J. (1993). Significant Influences on Children's Learning of Mathematics. *Science and Technology Education Series* , No.47.

Bogdan, R. C., & Biklen, S. K. (1998). *Qualitative Research in Education: An Introduction To Theory and Methods (3rd ed.) .* Boston: Allyn & Bacon.

Brinkworth, P., & Truran, J. (1998). *A study of the Influences on Students' Reasons for Studying or not Studying Mathematics .* The Flinders University of South Australia: School of Education.

Cao, Z. J., Bishop, A. J., & Forgasz, H. (2006). Perceived Parental Influence on Mathematics Learning: A comparsion among students in China and Australia. *Educational Studies in Mathematics, 64* , 85-106.

Chinnappan, M. (2007). Year 12 Students and Higher Mathematics: Emerging Issues . *Australian Association for Research in Education.* Wollongong.

Clarke, D., Shimizu, Y., Ulep, S. A., Gallos, F. L., Sethole, G., Adler, J., et al. (2006). Cultural Diversity and the Learner's Perspective: Attending to Voice and Context. In F. K. Leung, K.-D. Graf, & F. J. Lopez-Real, *Mathematics Education in Different Cultural Traditions: A comparative study of East Asia and the West* (pp. 353-380). New York: Springer.

Cohen, L., Manion, L., & Morrison, K. (2000). *Research Methods in Education.* London and New York: Routledge Falmer.

Dawe, L. (1995). Language and Culture in the teaching and learning of mathematics. Australia: Harcourt & Company.

Dobson, I. (2003). *Science at the Crossroads: A study of trends in university science from Dawkins to now 1989-2002 for the Australian Council of Deans of Science.* Sydney: UTS.

Forgasz, H. (2004). *Teachers and computer use for secondary mathematics teaching: Encouraging and inhibiting factors.* Melbourne: Australian Association for Research in Education [AARE] .

Fraenkel, K., & Wallen, N. E. (2006). *How to design and evaluate research in Education.* NY: McGraw-Hill.

Fullarton, S., & Ainley, J. (2000). Subject Choice by Year 12 students in Australian Secondary Schooling . *Australian Council for Educational Research* .

Fullarton, S., Walker, M., Ainley, J., & Hillman, K. (2003). *Patterns of Participation in Year 12.* Camberwell, Victoria: Australian Council for Educational Research.

Johnson, R. (1997). Examining the validity structure of qualitative research. *Education* , 118(2): 282-292.

Khoo, S., & Ainley, J. (2005). *Attitudes, Intentions and Participation .* Camberwell, Victoria : Australian Council for Educational Research .

Kruger, R., & Casey, M. A. (2000). Chapter 2 Planning the Focus Group Study. In *Focus Groups: a practical guide for applied research.* (pp. 20-37). Thousand Oaks, CA: Sage.

Leung, F. K., Graf, K.-D., & Lopez-Real, F. J. (2006). *Mathematics Education in Different Cultural Traditions: A comparative study of East Asia and the West.* New York: Springer.

Marks, G. (1998). *Attitudes to School Life: Their Influences and their effects on achievement and leaving school.* Camberwell, Victoria: Australian Council for Education Research.

Marshall, C., & Rossman, G. (1995). *Designing Qualitative Research (2nd ed.).* Thousands Oaks, CA: Sage.

McPhan, G., Morony, W., Pegg, J., Cooksey, R., & Lynch, T. (2008). *Maths?Why Not?* Canberra: Department of Education, Employment and Workplace Relations.

Smith, A. (2004). *Making Mathematics Count: The Report of Inquiry into Post-14 Mathematics Education in the United Kingdom.* London: Department of Education.

Welch, A. (2007). Cultural Difference and Identity. In R. Connell, C. Campbell, M. Vickers, A. Welch, D. Foley, & N. Bagnall, *Education, Change and Society* (pp. 155-187). Oxford University Press.