1994

Attitudes towards Mathematics of Vietnamese and non-Vietnamese senior secondary female students

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ATTITUDES TOWARDS MATHEMATICS OF VIETNAMESE AND NON-VIETNAMESE SENIOR SECONDARY FEMALE STUDENTS

by

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A Thesis Submitted in Partial Fulfilment of the
Requirements for the Award of

Bachelor of Education with Honours

Faculty of Education

Edith Cowan University

Date of Submission: 16th December, 1994.

USE OF THESIS

The Use of Thesis statement is not included in this version of the thesis.

Abstract

Throughout Australia and indeed in many parts of the world, there is a growing realisation that girls tend not to achieve their full potential at school, especially with regard to higher level mathematics units. Many girls limit their post-school options by choosing not to continue with mathematics when it ceases to be compulsory in Years 11 and 12. They also choose less difficult mathematics units and participate at a level below their potential. Much of the research has focused on gender differences in attitudes towards mathematics, and on participation and achievement in mathematics, but not on ethnic differences.

The purpose of this study was to investigate and compare the attitudes of Vietnamese and non-Vietnamese senior secondary female students towards mathematics. The study examined the effect that students' internal belief system (confidence in learning mathematics, usefulness of mathematics and perceptions about whether everyone can do mathematics) had on their decision to participate in post-compulsory mathematics units. The study also examined the effect that the external influences of the girls' mothers, fathers and teachers had on their internal belief systems.

All Vietnamese and non-Vietnamese girls from Years 11 and 12 of a Perth metropolitan Senior High School were invited to participate in the study. There were 39 non-Vietnamese respondents and 27 Vietnamese respondents representing 46% of the senior school female population. In the study, six scales of the Fennema-Sherman Mathematics Attitude Scales (Fennema & Sherman, 1976) were administered along with a personal data questionnaire. Each scale included an open-ended question. All scales were translated into

Vietnamese for ease of use by the Vietnamese girls. Further data was collected via interviews with six students.

The Vietnamese girls tended to find mathematics more useful and tended to be more confident in learning mathematics than the non-Vietnamese girls. The non-Vietnamese girls believed very strongly that mathematical ability was independent of gender. The Vietnamese girls tended to perceive that their mothers had a more positive attitude towards them as learners of mathematics than did the non-Vietnamese girls. There was no statistically significant difference between the way the Vietnamese and the non-Vietnamese girls perceived their fathers' and teachers' attitudes towards the girls as learners of mathematics. Parents of both groups of girls were reported as offering encouragement and support for their daughters' participation in post-compulsory mathematics.

The external influences impacted strongly on some of the components of the internal belief systems of both groups. Of the internal belief system components, the perceived usefulness of mathematics was the only variable which showed a statistically significant correlation with participation for the non-Vietnamese girls. None of the internal belief system components showed a statistically significant correlation with participation in mathematics for the Vietnamese girls.

The participation rate for both Vietnamese and non-Vietnamese girls in higher levels of mathematics was very low and appropriate ways of encouraging more girls to participate in the highest level of mathematics need to be developed.

Declaration

I certify that this thesis does not incorporate without acknowledgment any material previously submitted for a degree or diploma in any institution of higher education; and that to the best of my knowledge and belief it does not contain any material previously published or written by any other person except where due reference is made in the text.

Signature .

Date . . . 16.12.94 . . . . . .

Acknowledgments

I would like to thank Professor Nerida Ellerton, Research Supervisor for this study, for her professional guidance and gratefully acknowledge her assistance, encouragement and support. I would also like to thank the students who took part in the study, and their teachers for their co-operation and support throughout the study. Finally, I wish to thank my wife and children for their undying support and allowing me the opportunity to undertake post-graduate studies.

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Chapter 1

Introduction

Gender differences and affective issues in mathematics learning continue to attract considerable research attention. Although current educational policy documents recognise the importance of equitable educational outcomes for all students, little research has focused on the role of ethnicity in the mathematics classroom.

For example, the Western Australian Ministry of Education guidelines for Social Justice in Education (1991a) state in part that "social justice in education will be achieved to the degree that there are no significant differences in educational outcomes arising from ethnicity, race and sex" (p. 3). The policy and guidelines for the education of non-English speaking background students (Western Australian Ministry of Education, 1991b) provide that:

> Non-English Speaking Background (NESB) students will participate fully and achieve optimum outcomes in the curriculum through suitable provision for their linguistic, educational and cultural needs and that gender is no longer a variable affecting patterns of student participation, achievement and post-school options. (p. 3)

Through policies such as these, teachers have been made acutely aware of the needs of NESB students.

The Australian Association of Mathematics Teachers (AAMT) is also particularly concerned with the principle of equity for girls. In the document *A National Statement on Girls and Mathematics* (Australian Association of Mathematics Teachers, 1990) the AAMT noted that, for a variety of reasons, many girls chose not to continue with mathematics when it ceased to be compulsory at the senior secondary level. The AAMT also stated that girls must be encouraged to develop confidence in their ability to do mathematics and to

continue to take up opportunities to study mathematics if gender equity is to become a reality in our society. Similar concerns were expressed by Willis (1989) who noted that girls limited their post-school options by choosing not to study certain mathematics units.

It is of fundamental importance that educators have a sound appreciation for some of the affective variables which influence students' decisions regarding participation in mathematics. McLeod (1992) noted that affective issues play a central role in mathematics learning and instruction. *A National Statement on Mathematics for Australian Schools* (Australian Education Council, 1991) lists several goals which address affective issues. Two of these goals deal with the importance of helping students develop confidence and positive attitudes towards the power and use of mathematics.

Background

Interest in this particular area of study arose when the researcher was teaching at a senior Perth metropolitan high school in 1992. The school had a large Vietnamese student population (approximately 16%) and it was observed that, although lower school mathematics classes included a number of Vietnamese girls, few Vietnamese girls were in the higher level mathematics classes at senior level.

Aware of the fact that girls tend not to participate in post-compulsory mathematics, it was of interest to speculate whether Vietnamese girls shared the same attitudes towards mathematics as their non-Vietnamese counterparts or whether different factors impinged on their decisions to enrol in post-compulsory mathematics units.

Purpose

The purpose of this study is to investigate and compare the attitudes of Vietnamese and non-Vietnamese senior secondary female students towards

mathematics, and to study various external influences which may impact on their decision to participate in post-compulsory mathematics units.

Affective variables have to do with feelings, emotions, moods, beliefs and attitudes, and so are difficult to define, measure and understand accurately. Fennema (1981), Hart (1989) and Simon (1982) observed that the affective domain was a complex one and had received less attention than the cognitive domain. Similarly, McLeod (1992) observed that research on mathematics education continued to reside on the periphery of the affective field and that affective issues needed to occupy a more central position in the minds of researchers. In this way, research on learning and instruction would have a greater impact on students and teachers.

The affective variables in this study are: (a) perceived usefulness of mathematics; (b) confidence in learning mathematics; and (c) stereotyping mathematics as a male domain. In addition, external variables which have been shown to impact on girls' decisions to participate in post-compulsory mathematics will also be examined. These include: (a) perceived parental attitudes towards their daughters as learners of mathematics; and (b) perceived teachers' attitudes towards the girls as learners of mathematics. These factors will be studied in the context of situational variables such as age, socio-economic background, and length of time in Australia.

Participation will be the dependent variable and will be ranked according to difficulty level of the mathematics studied. There are eight senior secondary mathematics units: Applicable Mathematics, Calculus, Discrete Mathematics, Modelling with Mathematics, Mathematics in Practice, Introductory Calculus, Geometry and Trigonometry, and Foundations of Mathematics. Applicable Mathematics, Calculus and Discrete Mathematics are Year 12 TEE (University entrance) units and Introductory Calculus, Geometry and Trigonometry, and Foundations of Mathematics are Year 11 units which are the pre-requisites for the TEE units.

The literature on the affective domain and its relationship to females' mathematics participation and achievement is extensive. The following review examines the literature on attitudes, beliefs, emotions and motivation in mathematics education. The components of the internal belief system which have been proposed in the literature to impact on differences in mathematical achievement and participation are described in conjunction with the external factors which influence the teaching and learning process. The review concludes with a brief overview of research on mathematical achievement and on the participation by females.

Chapter 2

Literature Review

Introduction

Over the last 30 years a substantial literature has developed in the area of girls and mathematics. Much of the discussion has focused on differences observed between girls' and boys' achievement in mathematics and many research studies have examined possible reasons for this. Willis (1989) noted that, during the nineteen-sixties, research focused on why girls did not do as well as boys in mathematics. Willis further noted that by the nineteen-seventies:

> It was still understood, of course, that girls achieve less well than boys in mathematics, but there had been a subtle, although significant, shift; less often did we ask, "Why *can't* girls do as well as boys in mathematics?" and more often, "Why *don't* girls do as well as boys in mathematics?" (p. 3)

The literature on (a) general issues (ethnicity, gender, attitudes, emotions, beliefs); (b) internal beliefs (lack of confidence, usefulness, gender-role stereotyping, the fear of success construct and attributions); (c) external influences (parents, teachers, peers, school and society as a whole); and (d) outcomes (achievement and participation), will be examined in this review.

Ethnicity and Mathematics

Despite the amount of research on gender differences and mathematics, there has been little research concerning the effects of ethnicity on attitudes to mathematics. A meta-analysis of mathematical attitudes and affect by Hyde, Fennema, Ryan, Frost and Hopp (1990) drew attention to the fact that ethnicity in this particular research area had been largely ignored, with the vast majority of studies investigating differences between the attitudes of boys and girls. Of the

126 separate studies involving 63,229 subjects, 93% had been coded "ethnicity mixed or unreported" by Hyde et al. (1990). Similarly, in a meta-analysis of gender differences in mathematical performance by Hyde, Fennema and Lamon (1990), 98% of the 3,175,188 subjects were coded "ethnicity mixed or unreported."

Hyde et al. (1990) and Leder (1992) concluded that mathematical attitudes and affect for different ethnic groups may also show variations and were worthy of investigation. Hau and Salili (1991) found the top five attributions for achievement in mathematics in Hong Kong secondary students to be, in order of importance, effort, interest in study, study skill, mood and then ability. It would seem that the interactive components of attitudes and beliefs play a far greater role than that of students' innate belief in their own ability to succeed.

Biggs (1989) cited a number of studies which showed that Asian students both at home and abroad achieved significantly higher than Western students in the areas of mathematics and science. In a study of the influences on career choices of Vietnamese girls, O'Brien (1990) found that the Vietnamese culture placed a very high value upon education for girls. O'Brien also found that Vietnamese girls valued a good general education for reasons such as character building, independence and better career choice. These characteristics were also echoed by Do Quy Toan (1989) who noted that the literal translation of "education" is "teaching and bringing up" in the Vietnamese language and that families expected their children to succeed in school as a matter of family pride and honour.

In a Rhode Island, USA, study (cited by Willis, 1989, p. 16) into a talent search of mathematically gifted children, only 27% of the Caucasian winners were girls, while 47% of the Asian winners were girls. Overall, 17.5% of the winners were of Asian background even though they made up only 1.7% of the population in the region. A study by Lovejoy and Barboza (1984) conducted in New South Wales produced data which showed that gender differences in

mathematics anxiety and attitudes towards mathematics were greater among Australian students than among Asian students.

Biggs (1989) observed that effective assimilation of content, including mathematics, varied with a student's competence in the language in which the content was taught, and O'Brien (1990) described Vietnamese girls as requiring a transition period in order to adjust to the Australian education system which meant more than just learning a new language.

Gender

There is some inconsistency in the literature in the ways in which the terms "sex" and "gender" are used. Leder (1992) described gender differences as the non-biological characteristics, psychological features or social categories which emphasise the role played by the environment, both personal and situational, in which learning takes place.

Gender identity is a learned self-perception and is closely related to cultural definitions of femininity and masculinity (Coon, 1986). Gender identity is linked to the sex-roles attributed to members of a society. Coon (1986) and Bee (1989) defined sex-roles as the patterns or sets of behaviours which are encouraged and are expected of individuals in society based on their gender. Similarly, the AAMT (1990), in its *National Statement on Girls and Mathematics,* noted that gender was socially constructed through the interactions of children with adults and with each other. Children come to school with a strong sense of gender identity which is further reinforced and developed at school. Unfortunately, at many schools there are both implicit and explicit observations about the relationship between mathematics and the ascribed gender-role of students.

Leder (1992) noted that gender differences in mathematics learning highlighted the role played by the environment, both personal and situational, in which learning took place. It would appear that the pressures imposed by social and cultural stereotypes with respect to cognitive skills, gender appropriate

behaviours, and educational and life patterns all have an impact on any real or perceived gender differences in mathematics learning.

Attitudes, Beliefs and Emotions

Attitudes towards mathematics are multidimensional because there are different kinds of mathematics as well as a variety of feelings about each type of mathematics (McLeod, 1989, 1992). McLeod also noted that, although the research on affect had been extensive, it did not appear to have had a powerful influence on the field of mathematics. Various theoretical models for research on affect have been proposed (see, for example, Kulm, 1980; Fennema & Peterson, 1985; Eccles, Adler, Futterman, Goff, Kaczala, Meece & Midgley, 1985). These will be examined in greater detail in Chapter 3. Hart (1989) observed that, for some psychologists, attitude and belief are different constructs. It was generally accepted, however, that preferences and attitudes are traits, albeit transient ones, of the individual, whereas emotions and moods are situational or time-specific states (Lester, Garofalo & Kroll, 1989).

There are a number of related concepts from the affective domain which provide a framework for research on beliefs, attitudes and emotions towards mathematics. These include: (a) confidence in learning mathematics; (b) self-concept; (c) mathematics anxiety; (d) attributions related to mathematics learning; (e) learned helplessness; and (f) motivation. These will be described in the following sections.

Attitudes. An attitude can be defined as a learned predisposition to respond to people, objects, activities, ideas or institutions in a negative or positive way (Coon, 1986; Hart, 1989; Kulm, 1980). The effects of attitudes can clearly be seen in the actions and views of everyone around us. Attitudes summarise past experiences and predict or direct future actions. The work of Fennema and Sherman (1976, 1977, 1978), Kulm (1980), Reyes (1984), Fennema and Peterson

(1985), Eccles et al. (1985), and Leder (1987) are characteristic of the research carried out over the past 30 years.

The interaction between attitudes, beliefs and emotions have been described by Coon (1986) and Hart (1989). Both noted that attitudes could be expressed in three ways: (a) a belief component; (b) an emotional component; and (c) an action or behaviour component. Similarly, McLeod (1992) noted that attitudes towards mathematics appeared to develop in two different ways: (a) attitudes may result from the automatisation of a repeated emotional reaction to mathematics; and (b) the assignment of an already existing attitude to a new but related mathematical task.

Attitudes can be acquired in a number of ways. First, attitudes can form through direct contact with the object of the attitude (for example, the dislike of mathematics developed by students when they keep failing). Second, attitudes are also learned through the interaction with others holding a similar attitude. Students who interact in a supportive mathematical classroom environment tend to share positive attitudes towards mathematics. Third, attitudes can be learned at home. Parents who dislike mathematics themselves, or who give little encouragement and show minimal interest in their children's achievements, are more likely to instil negative attitudes in their children. Finally, many attitudes are influenced by the mass media. The values and information channelled into students' consciousness exert a powerful influence on how they perceive, think about, and react to their world. Although programs designed to support the education of girls have resulted in girls achieving at a higher level, staying at school longer and participating in higher-level mathematics and science, there is still a widespread stereotypical attitude that girls cannot fulfil a similar role in society to that ascribed to boys.

McLeod (1992) noted that research on attitudes provided a broad and indistinct picture of a limited range of affective responses to mathematics. McLeod further noted that research methodologies needed to become more

flexible with the use of multiple research approaches so that research on attitudes could make new contributions to the teaching and learning of mathematics.

Beliefs. Hart (1989) described beliefs as non-observable theoretical entities postulated to account for certain observable relationships in human behaviour. Beliefs often interact with and, at times, shape attitudes and emotions (Lester et al., 1989). Research on beliefs in mathematics education has become an important thread linking a number of studies which have focused on teaching on the one hand, and on students on the other (McLeod, 1992). The research has been diverse and has used different methodologies depending on the particular theoretical perspective of the researcher. For example, Schoenfeld (1989) came from a problem-solving perspective and observed that the development of beliefs about mathematics was influenced by the cultural setting of the classroom. Similarly, Lester et al. (1989) came from a problem-solving perspective but conjectured that students' beliefs about self, mathematics and problem solving played an important role in the behaviours which students exhibited in the mathematics classroom.

Research studies concerning students' beliefs about mathematics have been conducted by several mathematics educators. Students believe that mathematics is: (a) important and useful; (b) difficult; (c) based on rules; (d) mostly memorising; and (e) made up of problems which have no solution if they cannot be solved within a few minutes (McLeod, 1992; Schoenfeld, 1989). Wong and Herrington (1992) also noted that the beliefs that students held about particular strategies for dealing with mathematics affected their belief about mathematics. These beliefs encompassed aspects of strategy, task and person awareness.

There is a set of beliefs that students and teachers hold about mathematics teaching and learning which are important to the study of affect in mathematics education. Teaching is a complex and cognitively demanding process. Peterson, Fennema, Carpenter and Loef (1989) noted that teachers' beliefs, knowledge,

judgements, thoughts, and decisions had a profound effect on the way they teach as well as on students' learning in their classrooms. Teacher beliefs about the teaching and learning process of mathematics can change with professional development. Mathematics teachers participating in the *Urban Mathematics Collaborative Project* (Middleton, Webb, Romberg & Pittelman, 1990) held flexible, multidimensional conceptions about the nature of mathematics and to the approaches of mathematics teaching. The teachers felt that the project had given them greater flexibility in thinking about mathematics, more exposure to new ideas and methods, and had made them more aware of the needs of their students.

Students' perceptions of their teachers' attitudes towards themselves as learners of mathematics play an important part here. If students believe that their teachers have a positive attitude towards their ability to participate and achieve in mathematics, then they will respond accordingly.

In a study by Marcelo (1987) distinct differences between the beliefs and theories of the teachers under examination were reported. Marcelo noted that the teaching styles adopted by teachers are consistent with the beliefs that they have towards the content, the students, the class rhythm, classroom management and student evaluation. Similarly, in a study of fourth grade primary classes, Barr (1988) found that teachers' beliefs clearly influenced content coverage and the methodology employed to teach that content.

There have been few studies on teacher beliefs (Clark & Peterson, 1986). The majority of these studies have focused on teachers' perceptions of their roles, their general beliefs about the curriculum and how their beliefs impinge on their classroom behaviours (Peterson et al., 1989). Peterson et al. concluded that further research which examined the interrelationship between teachers' pedagogical content beliefs and their pedagogical content knowledge was needed.

Beliefs about the social context of instruction and more generally about cultural issues in mathematics education have received increased attention in

recent years (see, for example, McLeod, 1992). Cobb, Yackel and Wood (1989) found that the explicit teaching of social norms in a primary classroom was directly related to the types of affective reactions that the students themselves expressed. Similarly, Grouws and Cramer (1989) observed secondary classrooms where the effective teaching of mathematical problem solving was characterised by a supportive classroom environment in which social norms encouraged students to be enthusiastic and to enjoy mathematical problem solving.

Emotions. Physiological arousal in people is described as an emotion and assumes that, when aroused, people need to interpret their feelings (Coon, 1986). Coon described an emotion as having a physiological change in the body and the outward expressions of that change.

Mandler (1989) noted that emotional phenomena could be viewed in two different ways. The first view describes emotions as discrete patterns of behaviour, experience, and neural activity which could be considered the primary emotions such as fear, joy and anger. The second view describes emotional experience (and behaviour) as the result of cognitive analyses and physiological responses.

These aspects can be seen in the work of Buxton (1981) who reported adults' emotional reactions to mathematical tasks as panic. Their reports of panic were accompanied by a high degree of physiological arousal which disrupted their ability to concentrate on the task at hand. The emotional reaction can be described as fear, anxiety and embarrassment, as well as panic. These constructs are well documented in the literature (see, for example, Reyes, 1984; Leder, 1992).

McLeod (1992) concluded that data from a variety of sources and a variety of theoretical perspectives would suggest that careful observation of students, along with detailed interviews, should assist in the understanding of the complex

interactions involved between the emotional states and observed behaviours of learners of mathematics.

Motivation

Motivation can be defined as something that energises and directs behaviour (Woolfolk, 1990). Studies of motivation have generally focused on three main questions. First, what is it that originally causes a person to initiate some action? Second, what causes a person to move towards a particular goal? And third, what causes a person to persist in attempts to reach that goal?

One of the difficulties with the work on motivation is the diffuse nature of the field which often appears to be made up of disconnected components dealing with such topics as achievement motivation, social motivation, extrinsic versus intrinsic motivation, fear of success and so on (McLeod, 1992). According to Mandler (1989), part of the problem is that there is no framework for research on motivation which fits comfortably into current research in cognitive psychology. Achievement motivation and its related construct attribution theory will be examined later in this chapter under the heading *Attributions* and in Chapter 3 in the section on attribution theory.

Because of increasing dissatisfaction with the teaching-learning process in the mathematics classroom, many teachers have endeavoured to recognise the importance of affective factors which influence students' mathematical behaviours in the classroom. One of the approaches adopted for research in this area has been to examine motivation not only from a student perspective but also from that of the teacher and the classroom environment. Ponte, Matos, Guimaraes, Leal and Canavarro (1994) suggested that, under appropriate conditions, mathematics teachers are willing to change some of their views and practices towards the teaching and learning process.

It has been recognised that the curriculum and its delivery play an important part in the way that both teachers and students view mathematics. The

curriculum itself affects the motivational environment which both delivers and receives it. A willingness to change and adapt will, in turn, influence the content and delivery of the curriculum. Successive paradigmatic shifts in the focus of education have the potential to capitalise on human passion, bringing about creative and innovative changes (Ponte et al., 1994).

Researchers have recognised the importance of further research on motivation and its relationship to student behaviour and achievement in mathematics (see, for example, Marshall, 1987; Popolo & Shannon, 1987; Schoenfeld, 1989; Stocking & Goldstein, 1992). The mathematics classroom should be a supportive environment in which students learn mathematical concepts, facts and skills, become active participants in a number of mathematical processes, display positive attitudes and feelings towards mathematics, and acquire the necessary strategies and beliefs to learn how to learn mathematics. To achieve these aims, all participants in the teaching and learning process need to feel motivated. Ideally, they should be intrinsically motivated but sometimes the short-term benefit of extrinsic motivation may be more appropriate.

Internal Beliefs

Much of the recent literature in the affective area has focused on the internal belief system of girls in relation to their achievement and participation in mathematics (Hyde et al., 1990; Leder, 1992; Meyer & Koehler, 1990; Pedro, Wolleat, Fennema & Becker, 1981). Students, both male and female, bring into the classroom a wide range of skills, prior knowledge, work and study habits, attitudes and beliefs. These variables interact with what takes place in the classroom and influence the students' learning of mathematics.

Internal belief variables include confidence, risk-taking behaviour, attributional style, learned helplessness, anxiety, persistence, motivation and the fear of success construct. Pedro et al. (1981) identified five attitudinal variables which demonstrated gender-related differences. They noted however, that the

contribution of research in this area towards understanding the underlying reasons for students' decisions to participate in mathematics units was largely unexplored.

Confidence. Confidence in mathematics can be defined as the belief about one's own ability to do mathematics — that is, the ability to participate actively in, and achieve some form of success in, mathematics. Confidence in learning mathematics is the particular component of self-concept which is specific to mathematics (Reyes, 1984). Confident students tend to learn more, feel better about themselves, and be more interested in pursuing mathematical ideas than students who lack confidence. It would appear that confidence in learning mathematics may lead to increased task persistence.

Fennema and Sherman (1977, 1978) conducted studies which revealed that females consistently showed less confidence in their ability to do mathematics than their male classmates. Fennema (1981) questioned why so many females developed a lack of confidence in their own ability to do mathematics. She further observed that, even when females succeeded in mathematics, they attributed their success to factors such as increased effort to a much greater extent than males.

Usefulness. Students' perceptions of the usefulness of mathematics both immediately and in the future is a variable which has been shown to be strongly associated with mathematics participation (Perl, 1982; Meyer & Koehler, 1990). Willis (1989) noted that both boys and girls regarded mathematics as useful, but as they proceeded through secondary school, girls became less convinced that mathematics was useful at a personal level. Similarly, Perl (1982) found that significant differences occurred between males' and females' perceptions of the usefulness of mathematics.

In a rapidly changing technological world, an increasing number of occupations require a background in mathematics and science. Barnes, Plaister and Thomas (1984) recognised that many girls did not see the relevance of mathematics and science to their future lives as women, nor did they see the usefulness of these subjects to their future careers. Barnes et al. argued that girls needed to expand their career options by maintaining an interest in mathematics and science and that they should be encouraged to become aware of the importance of these subjects. Girls should also be encouraged to study mathematics at levels which are appropriate and commensurate with their real, not perceived, ability.

Similarly, the Australian Association of Mathematics Teachers (1990) noted that girls are more likely to choose subjects on the basis of interest and perceived social relevance, and that fewer girls than boys perceive mathematics as important and useful in their future lives.

Gender-role stereotyping. The value of mathematics to a female can be influenced by whether or not she thinks studying mathematics is an appropriate activity for females in general. Fox, Tobin and Brody (1979), for example, concluded that parents and teachers believe that mathematics is a more appropriate activity for males than it is for females. Fennema (1981), and Meyer and Koehler (1990) also found that if girls felt that mathematics was inappropriate for them, then they would have more negative attitudes towards mathematics because they would have to deny their femininity or their ascribed gender-role in society in order to be successful in studying mathematics.

Fear of success. The fear of success construct describes the conflict, resulting fear and decreased performance which results when females perceive a clash between attaining success and fulfilling their female role in society (Meyer & Koehler, 1990; Leder, 1992). This fear of success construct is also consistent

with the lower confidence expressed by females about their ability to do mathematics.

Attributions. The way in which students attribute causation for success and failure has received considerable attention in the research literature on affect (see, for example, Bar-Tal, 1978; Fennema, 1981; Leder, 1992; Meyer & Koehler, 1990; Reyes, 1984; Weiner, 1974; Weiner, 1986; Willis, 1989; Wolleat, Pedro, Becker & Fennema, 1980). The research literature closely links causal attributions of achievement with motivation. Attributional theories of motivation deal with the reasons or attributions that individuals make and how those attributions translate into actions (Weiner, 1984). Although, at times, the place that motivation has in the research on attributional style and achievement seems unclear, Kloosterman (1990) did note that motivation formed a theoretical rather than an empirical link between attributions and achievement. As noted earlier, motivation is an important variable to be considered in the mathematics learning and teaching process.

Bar-Tal (1978) established that strong relationships existed between attributions and achievement-related behaviours such as persistence, effort and choice of challenging tasks. Leder (1992) noted that, although, both males and females considered effort to be an important factor for success, males were more likely than females to attribute success to stable causes such as ability, and failure to unstable causes such as lack of effort.

Leder (1992) described the more functional pattern of this typical male attribution as "mastery orientation" whereas the pattern for females was often described in the literature as "learned helplessness." Reyes (1984) described learned-helplessness students as ones who felt that they had no control over their success or failure on academic tasks. They attributed their success to the ease of the task or to luck, and their failures to a lack of ability. McLeod (1992) described mastery orientation as being characteristic of students who made few

attributions, monitored their own performance, and saw intelligence as a growing collection of concepts and procedures that they are able to understand. Leder (1992) noted that many studies carried out within a mathematical setting provided qualified support for the less functional attributions of success and failure made by females in comparison with their male counterparts. Kloosterman (1990) also reported that females were more likely than males to show a decrease in performance after experiencing failure but found that there were no gender differences in attributional style between males and females. However, Kloosterman (1990), like Bar-Tal (1978) earlier, did find that there was a consistently positive relationship between achievement in mathematics and attributional style as analysed from self-reports of attribution.

Weiner's (1974) model of causal attribution has been widely cited in the literature (see, for example, Fennema, 1981; Fennema & Peterson, 1985; Fennema, Wolleat, & Pedro, 1979; Kloosterman, 1990; Pedro et al. 1981; Wolleat et al., 1980) and will be described in more detail in Chapter 3. In essence, Weiner found that the reasons people gave for their successes and failures fell into four categories: ability, effort, task and luck. The model suggested that causes of achievement outcomes can be rated on two dimensions: (a) loc.is of causality (which can be either internal or external); and (b) control (which can be either stable or unstable). Reyes (1984) found that, on average, females and males differed in their patterns of attribution of success and failure.

Reyes (1984) also noted that attributional patterns were related to an individuals' future expectations of success and failure as well a person's self-concept. Meyer & Koehler (1990) noted that analyses of attributional style gave valuable information about students but failed to answer the question of how students developed their own belief systems and how beliefs influenced them in their study of mathematics.

External Influences

There are a number of external influences which impinge on the individual as a learner of mathematics. Leder (1990) categorised these environmental variables as: (a) home; (b) school; and (c) societal. A general overview of the relevant literature concerning parents, teachers, peers, school and society will be presented in the section which follows.

Parents. Eccles and Jacobs (1986), Fox et al. (1979) and Stamp (1979) argued that parents exert a powerful and direct effect on children's attitudes towards mathematics. They further argued that support and encouragement from parents were crucial for girls in their decision to participate in post-compulsory mathematics units in high school. A similar view was supported by Hartley and Maas (1987) who found that Vietnamese parents, irrespective of their own educational level or prior school experience, had high aspirations for their children. They also found that Vietnamese parents talked to their children about the value of education and offered them as much support in their studies as possible.

Teachers. Despite any pedagogy employed by an individual teacher in the classroom with respect to the teaching of mathematics, teachers are still bound by school policies, and so play an important role in carrying out those policies. In turn, these school policies influence students' behaviour. Leder (1992) noted that research on teacher-student interactions had attracted international attention, but commented that there were limitations in those studies which attempted to capture the complex and multi-faceted classroom environment by using only a single observational instrument.

For Vietnamese students, there is a conflict between the respect that is accorded teachers in Vietnam and the apparent lack of status accorded to teachers in Australia. Hartley and Maas (1987) described Vietnamese attitudes towards

teachers as being highly respectful. In Vietnam, a teacher's role is regarded not only as one of imparting knowledge, but also as one of promoting good behaviour and a sense of morality.

Peers. The peer group acts as a socialisation agent and is recognised as an important factor on attitudes towards participation in mathematics courses (Fox et al., 1979; Leder, 1990; Leder, 1992). Peer values reflect, reinforce and shape differences in the beliefs, attitudes and behaviours of those individuals who comprise the group.

Fox et al. (1979) found that there was scant peer support for girls who were talented or interested in mathematics. This coincides with the perception by many girls that mathematics is a male domain. Among Vietnamese students, Hartley and Maas (1987) found that students shared a great deal of information amongst themselves and friends about schooling, subject options and career decisions. They also felt that adolescent Vietnamese students required a high degree of confidence and understanding of the Australian education system before they could cope with the transition from school to post-school. Not only was the role of the peer group important, but so also was the role of teachers and of the school in general.

School. There are a number of ways in which schools, and teachers within those schools, differentiate between groups of students. The former do so through their organisational procedures; the latter through their behaviours, expectations and beliefs (Leder, 1992). School culture differs between Australia and Vietnam. In Vietnam, teachers have more respect from their students and the conditions under which they work are more like university teaching in Australia (Hartley & Maas, 1987). Much of the administrative work and disciplining of students is done by supervisors and not by teachers. In Australia, unlike Vietnam, teachers have to perform a wide variety of roles consistent with

community expectations. Toan (1989) described the Vietnamese traditional education system as one which focused on the moulding of the personality of the student learner.

For Vietnamese families, there tends to be a lack of understanding of the Australian education system which can differ markedly from what they were accustomed to in Vietnam. Hartley and Maas (1987) noted that teachers in Vietnam had a greater authority over their students, and parents expected the school and its teachers to get on with the job of educating their children. They presented anecdotal evidence to suggest that Vietnamese parents would prefer to send their children to non-government schools rather than government schools because they believed that standards of education, discipline, authority and morality would be higher in non-Government schools.

Wider society. There are many factors, provided either covertly or overtly by the wider society, which impinge on the development of students' attitudes and against which students measure their beliefs, aspirations and expectations. Leder (1992) and Fox et al. (1979), for example, believed that societal messages are conveyed through television, children's literature, textbooks, assessment tasks, and through other print and electronic media. These messages can convey distinct gender-stereotypical roles for people in society, and, in particular, the stereotypical view of mathematics as a male domain.

Because these messages tend to reinforce particular views of gender-appropriate activities, many girls perceive mathematics as an appropriate activity for males rather than for themselves as females (Fennema & Sherman, 1977, 1978). Thus a conflict develops between girls' gender-stereotyped role in society and their participation in mathematics.

Achievement

Most studies on mathematics achievement have focused on gender differences (see, for example, Armstrong, 1980; Fennema & Sherman, 1977, 1978; Fox, Tobin & Brody, 1979). Some studies suggest that very few girls are represented in the top 1% of mathematics students (Willis, 1989). Similarly, despite an equal number of entries from males and females in the student population, 91% of the three hundred and eighty medals which have been awarded to participants in the Australian Mathematics Competition between 1978 and 1993 were awarded to males and only 9% to females (Leder, Fullarton & Taylor, 1994).

In the Western Australian Tertiary Entrance Examination for 1993, 34% of females studying Calculus were awarded an A grade compared with 27.5% of males studying Calculus. However, of the 780 students who received an A grade in Calculus, 36% were females and 64% were males (Secondary Education Authority, 1994). No data were available to indicate the ranking of male and female students who received an A grade in Calculus. Thus, although the females who proceed to study higher level mathematics do achieve good grades, there is little data available to indicate the ranking of females among the top students.

Achievement and affective issues. Sherman (1979) found that the best predictor of mathematical performance was mathematical achievement and that affective variables generally showed less predictive power. In contrast, Rowe (1988) found that there was a strong association between achievement and confidence, with confidence being a significant predictor of achievement, especially for students in single sex classes. Similarly, in a nation-wide survey in the United State of America, Armstrong (1980) identified two groups of affective variables which were regarded as possible important predictors of mathematics achievement and participation. These were: (a) the perceived usefulness of

mathematics for educational and career goals; and (b) positive attitudes towards mathematics including confidence in learning mathematics.

Ethington and Wolfle (1984) examined students' exposure to mathematical experiences to explain variations in mathematical achievement. They concluded that these variations could be explained by differences in social and educational background, ability, attitudes, past and current mathematical performances, and the extent to which students have been formally exposed to mathematics in the classroom.

Participation

Leder (1990, 1992) noted that, in many western countries, there was an increasing tendency for more females than males to remain at school until the completion of their secondary education. The retention rate in Year 12 as a percentage of the Year 8 cohort for West Australian Government and non-Government schools still favoured females in 1993. For females, the overall retention rate was 72.8% compared with 65.2% for males (Secondary Education Authority, 1994).

In all Australian states some study of mathematics is required during the early secondary years but the states differ in their requirements with respect to the level and amount of mathematics to be studied (Willis, 1989). Jones (1988) reported that retention rates of Year 8 students into Year 12 mathematics varied considerably in mainland states. Willis noted that, on the national scene, about twice as many boys as girls took advanced mathematics units. Willis concluded that girls were less likely to study higher levels of mathematics than boys. Willis noted, however, that students studying a high level of mathematics were often required to study two mathematics units which females may be reluctant to undertake.

In a national study of Australian senior secondary school students, Ainley, Jones and Navaratnam (1990) found that the largest differences in participation

rates for males and females in Years 11 and 12 occurred for mathematics and science courses. In Year 12, 24.2% of males were in mathematics and science courses compared with 9.1% for females. In Year 11, the disparity was nearly as great with 23.5% of males and 11.7% of females enrolled in mathematics and science courses. Similar data were reported about the number studying science and mathematics in Western Australia in Year 12 in 1993. Of the 1993 Year 12 student population studying mathematics, 17.0% were females enrolled in Calculus and Applicable Mathematics courses whereas 25.8% were males. For those studying science, 15.3% were females studying Physics and Chemistry compared with 25.6% of males (Secondary Education Authority, 1994).

Mathematics has continued to be used as an academic filter for higher education and so when females do not participate in mathematics to their true potential, they limit their post-school options. Little research has been conducted to investigate the relationship between attitude and choice of mathematics units. In a review of research in mathematical education Bell, Costello and Kucheman (1989) reviewed evidence which suggested that the choice of mathematics for further study depended more on a student's expressed liking for the subject than on its perceived difficulty or usefulness.

Conclusion

Larger numbers of females are taking advantage of the prevailing and more acceptable institutional, educational, and professional climate and have shown themselves to be capable of achieving well in mathematics. The literature on affect and educational outcomes has been extensive but still focuses on gender differences in mathematics achievement and participation. Further research which recognises and examines the interactive effect of ethnicity, cultural socialisation practices, and expectations on affect in the teaching and learning of mathematics is needed.

McLeod (1992) noted that research on affective issues in mathematics education should invoke a wider variety of methodologies. Similarly, Leder (1992) felt that research paradigms should be adopted which would allow greater attention to individual differences and context-specific problems. Fennema (1989) noted that internal affect has a strong influence on mathematics learning and emphasised the need for research on affect to continue.

Chapter 3

Theoretical Models

Models which underpin research in the affective domain range from those based on a behaviourist perspective to those which adopt a cognitive approach. These include models which have proposed relationships between attitudes and behaviours towards mathematics (see, for example, Kulm, 1980) and those which attempt to explain the relationship between affective variables in the internal belief system and gender differences in mathematics achievement and participation (for example, Fennema & Peterson, 1985). More recent models describe the interaction between the cognitive and affective domain (Ellerton & Clements, 1994; Wong & Herrington, 1992), the psychological components which directly influence mathematics achievement and which serve as mediating factors for the indirect influences of prior constructs (Ethington, 1992), and the productivity factors of aptitude, instruction and environment which influence cognitive, behavioural, and attitudinal outcomes in education (Reynolds & Walberg, 1992).

Attitude-Behaviour Model

Kulm's (1980) model (see Figure 1) was developed as a source of hypotheses for research on attitudes towards mathematics. Given the attitude factor A (positive or negative), a mediating factor B (for example, liking or disliking mathematics), and a learning situation such as task difficulty or task importance, then an appropriate behavioural response such as task persistence will result. Attitudes are important both as independent and dependent variables.

Reyes (1984) observed that the benefit of the Kulm model was that it required the researcher to think carefully not only about attitude and behaviour but also about the details of the learning situation and any mediating factors.

Kulm (1980) concluded that, although the focus on hypothesis development did not guarantee future success in research on attitude, it did, however, provide a model for investigating attitude-behaviour relationships.

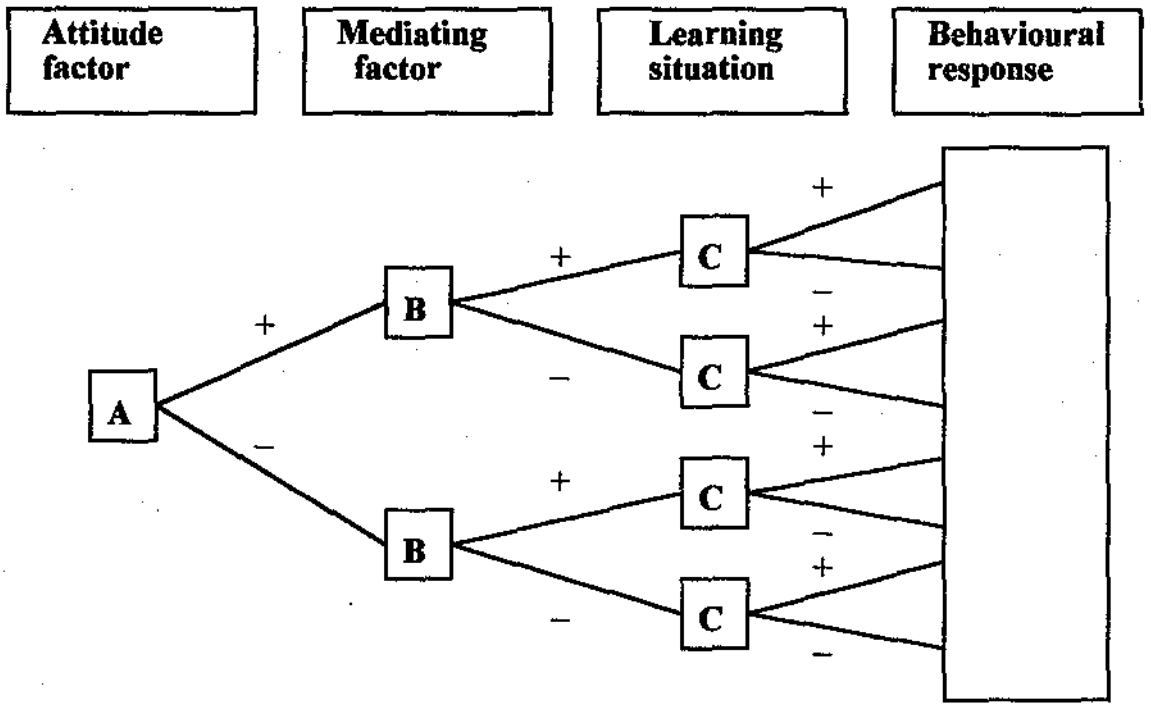

Figure 1. Model for attitude-behaviour relationships (Kulm, 1980).

Autonomous Learning Behaviour Model

The Autonomous Learning Behaviours (ALB) model (Fennema & Peterson, 1985) attempted to explain causation of gender differences in achievement on highly cognitive mathematical tasks. Differences may be caused by differences in autonomous learning behaviours, which are, in turn, caused by internal and external influences. Autonomous learning behaviours are seen as developing over a lengthy period of time and their development depends on both internal and external influences.

A student who is autonomous is one who increasingly *assumes* control of the learning process and who then *chooses* to engage in highly cognitive mathematical tasks and *prefers* to work independently on them. The autonomous

learner *persists* with the task when difficulties are encountered, and as a result, the learner experiences *success*. The subsequent experience of success on mathematical tasks strengthens the learners' internal belief system. This internal belief system is influenced by: (a) confidence; (b) the perception of the usefulness of mathematics; (c) attributional style; and (d) the gender-role stereotyping of mathematics as a male dominated activity.

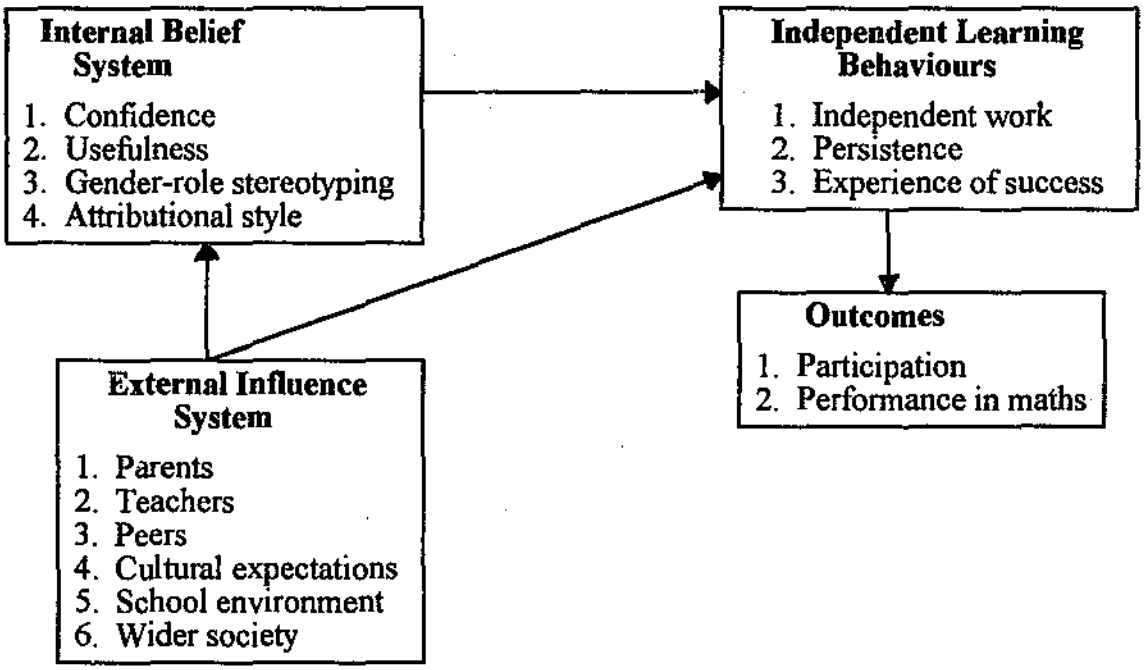

Figure 2. Autonomous learning behaviour model (Fennema & Peterson, 1985).

The ALB model (see Figure 2) also contains external and societal influences. These are varied and have been described in Chapter 2. The ALB model proposes that these influences directly impinge on the internal belief system of learners as well as on their learning behaviours. Reyes (1984) believed that research underpinned by this model could yield important information about the role of the classroom in the development of students' affective responses. It also provides a link between the affective domain and problem solving. Schoenfeld

(1989) noted that problem solving was a major component of competence in mathematics and more research on how the affective domain facilitated or debilitated problem-solving performance was needed.

The ALB model demonstrates the relationship between affective variables, classroom influences, and important outcomes of mathematics education (Fennema, 1989). Participation in autonomous learning behaviours acts as a mediator between affect, teachers and outcomes, whereas mediating factors in Kulm's model are linearly set between the attitude factor and the learning situation. Research has tended to focus on gender-related differences in the internal and external influences, and much less research has been reported on gender-related differences in autonomous learning behaviours (see, for example, Beahan, 1992).

Model of Academic Choice

The Model of Academic Choice (MAC) (Eccles et al., 1985) has been modified by Ethington (1992) and is similar to the ALB model of Fennema and Peterson (1985). The Model of Academic Choice proposed by Eccles et al. stressed the interactive qualities of a student's expectation of success, and of the perceived value of the task to explain students' decisions to enrol in particular mathematics units. Reyes (1984) described the Model of Academic Choice as a detailed, comprehensive framework for viewing the complex interrelationships among affective variables.

Meyer and Koehler (1990) described the ALB and MAC models as being important for a number of reasons Both models:

1. attempt to specify the interaction between variables related to gender differences in mathematics.

2. focus on observable behaviours which may result from beliefs.

3. suggest specific testable hypotheses which may lead to further refinement of the models.

Leder Model

Similar to the ALB model, a model proposed by Leder (1992) emphasised variables which were pertinent to mathematics educators and which should lead to improved classroom practices. Factors associated with the environment were incorporated into Leder's model which included variables such as home, school, classroom, parents, peers, teachers and curriculum variables, as well as cognitive and psychosocial variables associated with the learner.

Attribution Theory

Attribution theory presents a framework for attributions of academic success and failure. Research in mathematics education has tended to use a formulation of attribution developed by Weiner (1974). Weiner's model of causal attribution is shown in Figure 3 and considers the causes of success and failure which are categorised into a 2 x 2 matrix with locus of causality (internal and external) being one dimension, and control (stable and unstable) the other.

	Internal	**External**
Stable	Ability	Task
Unstable	Effort	Luck

Figure 3. Weiner 's (1974) model of attributions of causality.

Reyes (1984) felt that mathematics education research concerning attributions dealt mainly with students' and teachers' perceptions of the causes of student success or failure in mathematics. Weiner's model has been widely used to assist in understanding any gender-related differences in mathematics achievement and participation.

An Interactive Model

Recent theoretical models have attempted to formulate a framework which recognises the interactive effect that the affective and cognitive domains have on each other. For example, Wong and Herrington (1992) proposed an interactive model of mathematics learning which has, as its central focus, three clusters of variables about the learner, namely, learning strategies, mathematical outcomes and learner beliefs about themselves as learners of mathematics, mathematical tasks and coping strategies. Wong and Herrington felt that learner beliefs would impact on a mathematical problem's solution and so influence future beliefs about problem solving and the appropriateness of the strategies that the learner employed.

In a model proposed by Ellerton and Clements (1994), cognition and affect were integral components of a continuous cycle. Students, as learners of mathematics, held beliefs about mathematics and about self in relation to mathematics. Students reacted either positively or negatively to new stimuli which influenced their attitudes towards mathematics or parts of mathematics. Students then modified beliefs about mathematics and self in relation to mathematics within their cognitive domain.

The Australian Education Council (1991), in *A National Statement on Mathematics for Australian Schools,* recognised the importance of the interaction between the cognitive and affective domains. According to the *National Statement*, one of the goals of school mathematics is for students to gain pleasure from mathematics and appreciate its fascination and power. Another is that students should acquire the mathematical knowledge, ways of thinking and confidence to enable them to use mathematics in a variety of situations.

Research Model

This research proposal is underpinned by the theoretical framework shown in Figure 4 which has been adapted from the generic model for relating affect and

outcome (Fennema, 1989). It is similar to the Autonomous Learning Behaviour model (see Figure 2) but the framework adopted for the proposed model allows individual researchers to modify and refine specific details to meet their own needs and interests by including appropriate variables under each of the components of the model.

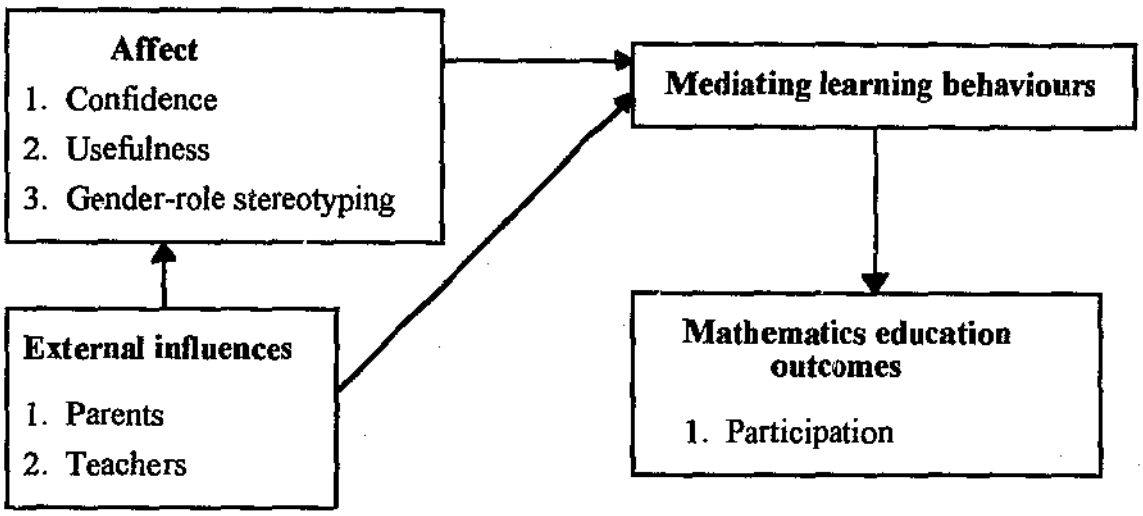

Figure 4. Theoretical model which underpins the research (adapted from Fennema, 1989).

The mediating learning behaviours necessary to improve participation rates in mathematics at post-compulsory level are a consequence both of the learner's internal belief system (affect) and the components of the external influence system.

The purpose of this study is to investigate whether or not the affective variables of: (a) a student's confidence in being an active participant in mathematics; (b) a students' perception of the usefulness of mathematics; and (c) gender-role stereotyping of mathematics, differ between Vietnamese and non-Vietnamese senior secondary female students. These affective variables have been shown to influence girls' decisions to participate in senior secondary school mathematics at the post-compulsory level (Meyer & Koehler, 1989). The

strength of the external influence of parents and teachers on the girls' attitudes will also be examined. A factor which impinges on the Vietnamese girls in the study will be the length of time they have spent in Australia. This will be taken into account as a situational variable along with age. Participation is the desired mathematics education outcome, and is the dependent variable, as per the model in Figure 4.

Conclusion

The various models described above have a number of common characteristics: (a) the emphasis on the social environment and the role of significant others in that environment; (b) students' reactions to the culture pervading the mathematics classroom; (c) the real and perceived value of the learning taking place; and (d) recognition of the interaction between the affective and cognitive domains. Leder (1992) noted that, although the proponents of the various models supported their preferred representation, they also acknowledged the need for further testing, clarification, and substantiation of the variables identified and the links hypothesised.

The model proposed in Figure 4 helps to address this need by forming a broader framework which allows different researchers to investigate other components or factors within the affective domain.

Chapter 4

Research Questions and Variables

Research Questions

Several affective variables related to gender differences in mathematics have been identified in Chapter 2. The purpose of this research is to determine whether Vietnamese and non-Vietnamese senior secondary female students have different attitudes towards mathematics, and to what extent affective and external variables impinge an any differences.

This study will examine three affective variables (confidence in learning mathematics, usefulness of mathematics, and the belief that everyone can do mathematics) which are components of students' internal belief system. This study will also examine three external influences (teacher, mother, and father) and their relationship with the internal belief system. The relationship between all six variables and participation will also be examined. The research model (see Figure 4) proposes that external influences impinge on students' internal belief system. The model also proposes that the relationship between both students' internal belief system and external influences, and participation are mediated by learning activities.

This study will attempt to answer a number of questions similar to those outlined by Meyer and Koehler (1990). These include:

1. Is there a statistically significant difference between the mean scores of the internal belief variables and the mean scores of the external influence variables for Vietnamese and non-Vietnamese senior secondary female students?

2. Is there a relationship between (a) the components of the external influences and (b) the components of the internal belief system of students in each group and their participation in mathematics?

3. Is there a relationship between the external influences of mother, father and teacher and the components of the internal belief systems of students in each group?

The internal and external variables to be measured are defined below and summarised in Table 1.

Table 1

Variables to be Studied to Determine Attitudes Towards Mathematics of Female Vietnamese and Non-Vietnamese Senior Secondary School Students

Independent variables	**Situational variables**	**Dependent variables**
Internal beliefs: 1. Usefulness 2. Confidence 3. Gender-role stereotyping **External influences:** 1. Parents 2. Teachers	1. Age 2. Length of time in Australia 3. Socio-economic background	Participation in: 1. Applicable Mathematics 2. Discrete Mathematics 3. Calculus 4. Modelling with Mathematics 5. Introductory Calculus 6. Foundations of Mathematics 7. Mathematics in Practice 8. Geometry & Trigonometry

Internal Belief Variables

Confidence. Confidence in one's own ability is related to what one is willing to attempt. Females tend to underestimate their own cognitive worth, especially in the area of mathematics (Fennema & Sherman, 1976). It is therefore important to be able to measure the confidence of an individual as a learner of mathematics. Fennema and Sherman (1978) found that anxiety, and hence confidence about learning mathematics, was more highly correlated with mathematics achievement

than any other attitudinal variable. They developed a *Confidence in Learning Mathematics* scale.

> The *Confidence in Learning Mathematics* scale is intended to measure confidence in one's ability to learn and to perform well on mathematical tasks. The dimension ranges from distinct lack of confidence to definite confidence. The scale is not intended to measure anxiety and/or mental confusion, interest, enjoyment or zest in problem solving. (p. 4)

The confidence variable in this study will be measured using the *Confidence in Learning Mathematics* scale developed by Fennema and Sherman (1976).

Usefulness. Pedro et al. (1981) noted that the perceived usefulness of mathematics was shown to predict the choice of mathematics units, and that attributions about the causes of performance outcomes had been shown to predict persistence and achievement in mathematics. The *Usefulness Of Mathematics* scale which was designed by Fennema and Sherman (1976, p. 5) to "measure students' beliefs about the usefulness of mathematics currently and in relationship to their future educational and vocational needs", will be used to measure the perceived usefulness of mathematics variable in this study.

Can everyone do mathematics? This title was reworded from the original *Mathematics as a Male Domain* scale (Fennema & Sherman, 1976) to reflect the notion that mathematics is not a gender-specific activity. For ease of data input, analysis and discussion the word *Everyone* has been adopted to refer to this scale. Fennema and Sherman (1976) noted that research evidence suggested that all students are likely to perform better on intellectual tasks which are perceived to be appropriate to their gender. Thus, if mathematics is perceived to be a male-specific activity, females may be less willing to pursue studies in this area. In a later study, Fennema and Sherman (1977) found that males, more than females, perceived mathematics as a male appropriate activity.

This current study will determine if there are any differences in the ways in which Vietnamese and non-Vietnamese girls view mathematical activities as specifically more appropriate for males than females. Fennema and Sherman (1976) described the *Mathematics as a Male Domain* scale as one which would measure

> the degree to which students see mathematics as a male, neutral, or female domain in the following ways: (a) the relative ability of each gender to perform in mathematics; (b) the masculinity/femininity of those who achieve well in mathematics; and (c) the appropriateness of this line of study for each students see mathematics as a male, neutral, or female domain in the gender. (p. 3)

External Influence Variables

As described earlier in Chapter 2, it appears that parents and teachers exert some influence on the way girls internalise and develop their attitudes towards mathematics and the way in which they exhibit learning behaviours. There is a widely held belief that parents of Vietnamese girls have a greater influence on their daughter's beliefs, aspirations and expectations than the parents of non-Vietnamese girls (Hartley & Maas, 1987).

Mother and father. The attitudes of significant others are important to the learning of mathematics. Fennema and Sherman (1976) developed a *Mother* and *Father* scale. The title was reworded to reflect more accurately the dimension of the scale. The instrument for this study used *My Mother's Attitude Towards Me as a Learner of Mathematics* scale to assess student's perceptions of their mothers' attitudes towards them as learners of mathematics. Similar scales were used for their fathers and teachers. For ease of data input, analysis and discussion, the words *Mother/Father* have been adopted to refer to these scales. Separate scales were used for mothers and fathers because there is evidence (see

Stamp, 1979) that mothers and fathers influence their children differently. The defined dimensions and items for the mother and father scales are identical except for the substitution of "father" for "mother" in the appropriate locations.

The *Mother/Father* scale was designed by Fennema and Sherman (1976) to "measure students' perceptions of their mother's/father's interest, encouragement, and confidence in the student's ability. It also includes the student's perception of their mother's/father's example as an individual interested, confident, and aware of the importance of mathematics" (p. 3). These scales will be used in this study to measure the mother and father variables.

Teacher. There is evidence that teachers treat males and females differently and that teachers often negate girls' academic performances, tending to emphasise traditional "feminine" attributes (Fennema & Sherman, 1976). In Vietnam, teachers are highly respected by their students and have a great deal of authority over them (Hartley & Maas, 1987; Toan, 1989). The way in which cultural expectations influence Vietnamese girls may change over time with greater exposure to the Australian "cultural milieu."

Fennema and Sherman (1976) designed the *Teacher* scale to "measure students' perceptions of their teachers' attitudes towards them as learners of mathematics. It includes the teachers' interest, encouragement and confidence in the student's ability" (p. 4). This scale will be used in this study to measure the teacher variable.

Situational

Bradley and Bradley (1984) noted that Asian students in Australia had problems which fell into three categories: (a) language (the use of English in academic situations); (b) culture (adjustment to and survival in a different environment); and (c) education (learning to operate in a new learning situation, with different assumptions and expectations for students).

Because of factors such as literacy skills, length of time in Australia and past educational experiences, many Vietnamese girls are slightly older than their peers. Bradley and Bradley (1984) suggested that teachers should endeavour to utilise this additional maturity in the classroom. The two situational variables to be measured are age and length of time in Australia. The other situational variable, socio-economic background of the students, will be described as part of the school profile in Chapter 5. The mean age of respondents by year level and ethnicity is given in Table 2 in Chapter 6. On average, Vietnamese girls in Years 11 and 12 are between 9 and 10 months older than their non-Vietnamese counterparts.

Participation

The five major senior secondary mathematics pathways in Western Australia are shown in Figure 5.

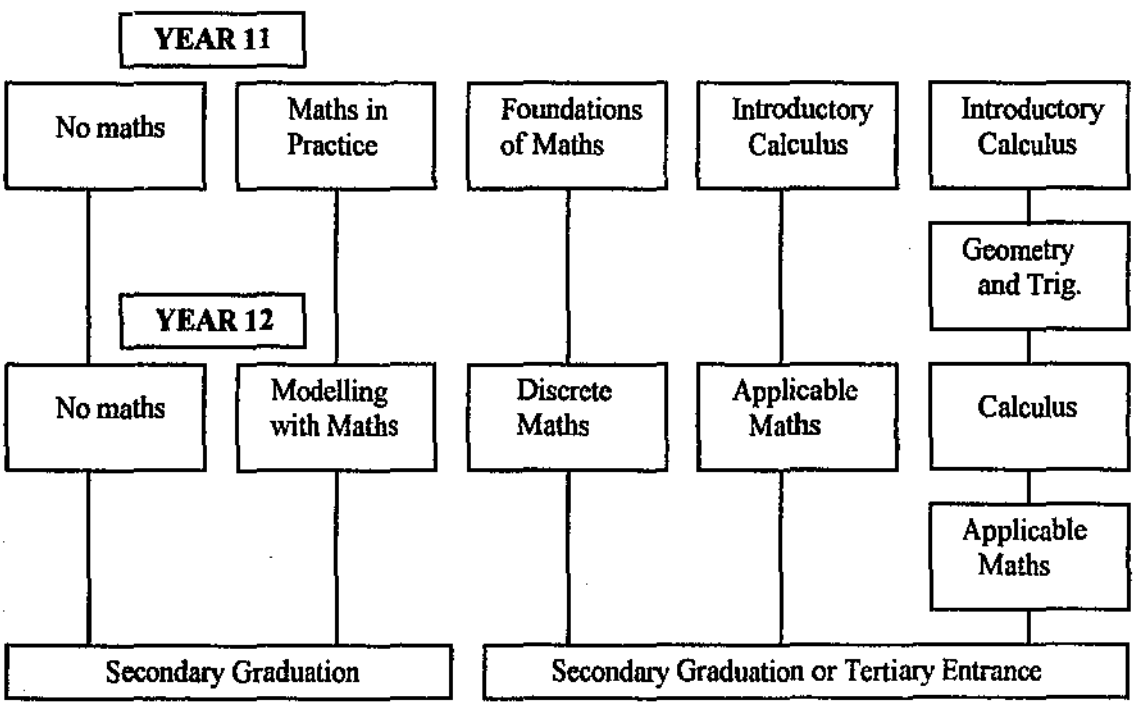

Figure 5. Mathematics pathways available in Western Australia in 1994.

Mathematics is not compulsory in Years 11 and 12 in Western Australia. Participation will be the dependent variable and will be ranked according to the difficulty level of the mathematics units (see Table 6 in Chapter 5 for the ranking of units used).

There are four mathematics units in each of Years 11 and 12. Applicable Mathematics, Calculus and Discrete mathematics are Year 12 TEE (University entrance) units. Some movement from one pathway to another is possible between Years 11 and 12.

Details of the instruments used, selection of participants, and coding of data are presented in Chapter 5.

Chapter 5

Methodology

Participants

All the girls from Years 11 and 12 (N = 141) of a Perth metropolitan senior co-educational high school were invited in August, 1994 to participate in the study. Permission letters and consent forms (Appendix C) were forwarded to all parents and guardians. Permission letters to Vietnamese families were translated into Vietnamese for their ease of understanding the purpose of the study. The overall response rate was 46%. The number and percentage of respondents who took part in the study in September, 1994 are shown in Table 2.

Table 2

Number and Percentage of Vietnamese and Non-Vietnamese Respondents in Years 11 and 12

Year	Non-Vietnamese	Vietnamese
11	24 (39.3)	14 (82.4)
12	16 (32.0)	12 (92.3)
Total	39 (35.1)	26 (86.7)

Note. The percentage of respondents in each cell is shown in parentheses.

School profile. The high school has a student population of 850. This population is characterised by considerable ethnic diversity. The students in the school represent approximately 30 different ethnic backgrounds as determined from the country of origin of their parents, the largest minority groups being Vietnamese (16.5%), southern European (8.2%) and Aboriginal (8%). The students of Vietnamese origin demonstrate a wide range of literacy skills and

prior educational experiences, and have been in Australia for between 1 and 15 years. The upper school population breakdown is given in Table 3.

Table 3

Number and Percentage of Upper School Population by Gender and Ethnicity

	Females		Males		
Year	Non-Vietnamese	Vietnamese	Non-Vietnamese	Vietnamese	Total
11	61 (40.1)	17 (11.2)	60 (39.5)	14 (9.2)	152
12	50 (40.3)	13 (10.5)	48 (38.7)	13 (10.5)	124
Total	111 (40.2)	30 (10.9)	108 (39.1)	27 (9.8)	276

Note. The percentage of each cell in relation to the total for that year level is shown in parentheses.

The school experiences high absentee rates with daily absences sometimes exceeding 16% of the student population. Families in the area are usually in Government-owned rental accommodation (>41%) rather than owner occupied accommodation (<20%). The proportion of single parent families within the area exceed 26%. Approximately 76% of the community population over the age of 15 do not have further educational or work-skills related qualifications. The number of individuals in the community with tertiary qualifications is less than 5%, and 16–20% of the community have trade qualifications. There are high levels of both adult unemployment (25%) and youth unemployment (30–43%) in the area which means that families have low levels of income. The percentage of households in the community who receive an annual income of less than $25,000 is 38–60%. Less than 2% of persons in the community aged 15 years and over have an annual income greater than $50,000 while 44–58% have an annual income of less than $12,000 (Australian Bureau of Statistics, 1993a).

The school itself has been established for 20 years with separate school buildings containing individual departments. The staff includes teachers, teacher assistants and non-teaching staff. Because of the number of special educational programs which target the special needs of its students, the school has a high proportion of non-teaching staff (18%) compared with the 4.3% State average for government schools (Australian Bureau of Statistics, 1993b). These programs operate successfully at the school, and attempt to overcome some of the disadvantages experienced by its students.

Table 4

Total Student Enrolments in Senior Secondary Mathematics Classes

	Females		Males	
Mathematics units	Vietnamese	Non-Vietnamese	Vietnamese	Non-Vietnamese
Calculus	0	1*	6*	2*
Applicable Mathematics	1	1*	8*	6*
Discrete Mathematics	4	13	1	15
Modelling with Mathematics	9	29	2	25
Geometry & Trigonometry	4*	0	1*	5*
Introductory Calculus	4*	2	2*	8*
Foundations of Mathematics	3	10	3	15
Maths in Practice	7	33	10	25
No mathematics	3	22	1	17

* Contains students who are enrolled in two mathematics units.

Close contact with the students of the school has been maintained by the researcher over the past two years. Many of the senior students in mathematics have been taught by the researcher who also acted in the capacity of relief teacher for other subjects. In effect, the researcher has been accepted as a part of the school community.

The total number of students enrolled in each senior secondary mathematics class at the time of the study is given in Table 4. Enrolments are categorised by gender and ethnicity.

Instruments

The wording of the six sub-scales of the Fennema-Sherman Mathematics Attitude Scales (Fennema & Sherman, 1976) was adapted to the Australian context (eg. "mathematics" has been substituted for "math" and "I keep doing poorly at mathematics" for "I have a knack for flubbing up math"). Each scale was administered to the sample described above during normal class time. The English versions of the instruments are shown in Appendix A. The ease of administration of the sub-scales constitutes an advantage, and is one of the reasons why they have been so widely used. However, one disadvantage of this type of instrument is that important information is sometimes not elicited when the items are part of a group which require pre-determined responses (Meyer & Koehler, 1990).

The six sub-scales are: (a) confidence in learning mathematics; (b) the usefulness of mathematics; (c) mathematics as an activity for everyone; (d) a teacher scale measuring the girls' perception of their teacher's attitude towards them as learners of mathematics; (e) a mother scale measuring each girl's perception of her mother's attitudes toward her as a learner of mathematics; and (f) a father scale measuring each girl's perception of her father's attitudes toward her as a learner of mathematics.

According to Fennema and Sherman (1976), the scales measure important, domain-specific attitudes which have been shown to be related to the learning of mathematics by all students and in particular to the educational outcomes of females. Each of these scales consists of 12 items — six positively stated and six negatively stated items — with four response alternatives (strongly agree, agree, disagree, and strongly disagree). Each response was given a score from 1 to 4 on each scale. On each scale, the higher the score the more positive the internal belief or external influence. For the *Everyone* scale, for example, a higher score indicates a belief that mathematics is for everyone, not only boys.

Neutral response. It was decided to remove the neutral response so that students were forced to make a decision regarding their position on an item. The issue regarding the neutral or undecided category for attitude scales using Likert-type responses has received some attention in the literature (see, for example, DuBois & Burns, 1975; Poole, 1982; Andrich, 1982; Cunningham, 1986). Cunningham (1986) noted that even if respondents felt as though they were being forced to make a distinction where none existed, the neutral position may be an easy way out for those students unwilling to devote an appropriate amount of their time to the task of responding to the items. Cunningham further noted that there was some evidence that, when forced to make a commitment other than the neutral one, respondents still make reliable decisions.

DuBois and Burns (1975) described the essential meaning of the neutral category as either one of ambivalence or indifference but may include: (a) respondents not feeling competent enough tc take a position; (b) respondents refusing to reveal their personal feelings; and (c) respondents not understanding the attitudinal statement. Because of the ambiguous meaning of the neutral category, DuBois and Burns concluded that attitude researchers should discontinue its use. Similarly, Andrich (1982) noted that, because an expression

of attitude was considered more informative, there was an appeal in constructing statements which did not attract neutral responses.

One of the disadvantages of denying the respondents the opportunity to make a neutral response is that the procedure could result in an increase in the amount of missing data since the respondents may simply refuse to respond if they cannot make a neutral response. This was alleviated somewhat because the scales were personally administered to all respondents by the researcher. Ten respondents asked if they could make a neutral response on some items in three of the scales (*Teacher*, *Mother* and *Father*). The main cause of concern was on the *Teacher* scale where some students did not know what the teacher thought of them as learners of mathematics. In these cases, the students were told to put a cross on the centre line between agree and disagree. Of all 4600 responses for all students on all scales, only 25 were marked neutral and these were scored as neutral (2.5).

Open-ended questions. Each individual has different experiences and perceptions, and these can go undetected when closed statements and questions are used. At the end of each of the six scales an open-ended question related to one dimension of the scale has been included. Respondents were encouraged to answer this question. Responses to each open-ended question were grouped under common themes for that question.

To gather more information, three Vietnamese and three non-Vietnamese students were subsequently interviewed to determine the reasons underlying their decision to participate in mathematics. Of the three non-Vietnamese students who were chosen one did not participate in mathematics while the other two participated at different levels. Of the three Vietnamese students who were chosen, one scored high on the *Confidence* and *Usefulness* scales but chose not to participate in mathematics at a high level while the other two participated in mathematics at a high level but whose scores on the six scales were dissimilar. These interviews were audiotaped.

Reliability. Pedro et al. (1981) noted that the reliability of the Fennema-Sherman Mathematics Attitude Scales ranged from 0.87 to 0.89. Pedro et al. did not name the reliability test that they had used whereas Fennema and Sherman (1976) determined that split-half reliabilities ranged from 0.86 to 0.93 for the scales used in their study. The reliability coefficients (Cronbach's alpha) of the scales used in the present study were determined. A summary of the reliabilities for the Fennema-Sherman study (1976) and the present study is given in Table 5. Fennema and Sherman further noted that construct validity was determined by the use of experts at the time of scale construction and subsequently validated by factor analysis.

Table 5

Reliability of Fennema-Sherman Mathematics Attitude Scales

Scale	Fennema-Sherman (1976)	Present study
Confidence	.93	.91
Usefulness	.88	.87
Male domain	.87	.91
Teacher	.88	.74
Mother	.86	.84
Father	.91	.87

Procedure

The respondents completed the six scales and a personal data questionnaire during the course of normal classes. For the most part these were conducted during mathematics classes, but at other times it was more appropriate to

administer the survey during other classes. Most respondents took between 20 and 25 minutes to complete the questionnaires although some Vietnamese girls took up to 55 minutes. All Vietnamese girls were given the opportunity either to complete the English version (Appendix A) or Vietnamese version (Appendix B) of the questionnaires. Only three Vietnamese girls chose to complete the Vietnamese version although three others completed the English version but used the Vietnamese version as a reference. The girls who completed the Vietnamese version had been in Australia less than 5 years, were approximately 19 years of age and had a good grasp of their written language.

Data Coding and Scoring

The responses for each item in the six scales were scored from 1 to 4 depending on whether the item was negatively or positively stated. For example, a strongly agree response on a positive statement would score a 4 whereas a

Table 6

Coding and Ranking of Mathematics Participation Levels

Level	Year 11	Year 12	Coding
High	Geometry & Trigonometry	Calculus	3.0
	Introductory Calculus	Applicable Mathematics	3.0
Medium	Introductory Calculus	Discrete Mathematics	2.5
	Foundations of Mathematics	Discrete Mathematics	2.0
Low	Foundations of Mathematics	Modelling with Mathematics	1.5
	Maths in Practice	Modelling with Mathematics	1.0
No maths	Maths in Practice	No mathematics	0.5
	No mathematics	No mathematics	0.0

strongly agree response on a negative statement would score a 1. The students' score for each sub-scale is the cumulative total of their responses to the 12 items on that scale.

Participation in the various mathematics units was coded as per Table 6. For the purpose of analysis, 0 and 0.5 were labelled "no mathematics," 1.0 and 1.50 were labelled "low level," 2.0 and 2.5 were labelled "medium level" and 3.0 was labelled "high level."

Chapter 6 presents details of the results of the six sub-scales and personal data. Responses to the open-ended questions and interview data will also be summarised in Chapter 6.

Chapter 6

Results

The Statistical Package for the Social Sciences (SPSS) (Kim & Kahout, 1975) was used to analyse the data. The scores obtained by Vietnamese girls and non-Vietnamese girls on each of the six scales were analysed using two-tailed *t*-tests to determine if ethnic differences in attitudinal patterns existed. Correlational analysis was used to examine any relationship between ethnicity, participation, situational variables and attitudinal patterns.

Attitudes Towards Mathematics

Mean scores and standard deviations for each of the six scales were calculated and are given in Table 7. The values of *t*-tests for differences between the means for the Vietnamese and the non-Vietnamese girls on each of the variables studied are also presented in Table 7.

Internal belief system. The confidence in mathematics of the Vietnamese girls ($M = 34.8$) was found to be statistically significantly higher than that of the non-Vietnamese girls ($M = 31.2$), $t\,(63) = 2.00$, $p < .05$. Not only did the Vietnamese girls tend to be more confident but they also tended to find that mathematics was more useful ($M = 39.8$) than the non-Vietnamese girls ($M = 36.4$), $t(63) = 2.64$, $p<.01$. In contrast, the non-Vietnamese girls perceived that mathematics was less a stereotypical male activity ($M = 44.0$) than did the Vietnamese girls ($M = 36.5$), $t(63) = 5.79$, $p<.001$.

External influences. The Vietnamese girls tended to perceive that their mothers had a more positive attitude towards them as learners of mathematics ($M = 38.8$) than did the non-Vietnamese girls ($M = 34.7$), $t(61) = 3.00$, $p<.01$. There was no statistically significant difference between the way the Vietnamese

Table 7

Means, Standard Deviations, Number of Respondents and Two-Tailed t-Values for Each Sub-Scale

	Non-Vietnamese		Vietnamese		
	Mean (SD)	Number	Mean (SD)	Number	*t*-value
Confidence	31.2 (8.2)	39	34.8 (5.0)	26	2.00*
Usefulness	36.4 (5.8)	39	39.8 (3.9)	26	2.64**
Everyone	44.0 (4.4)	39	36.5 (6.1)	26	5.79**
Teacher	35.0 (4.4)	39	35.2 (4.2)	26	0.21
Mother	34.7 (6.0)	39	38.8 (3.8)	23	3.00**
Father	36.0 (7.4)	38	38.5 (4.4)	23	1.47

*$p<.05$. **$p<.01$.

and the non-Vietnamese girls perceived their teachers' attitudes towards the girls as learners of mathematics [$t(63) = 0.21$, $p > .05$]. However, when the girls responded to the statement "My teacher thinks advanced mathematics is a waste of time for me" (Item 9 on the *Teacher* scale) there was a statistically significant difference in their responses (Table D4 in Appendix D). The Vietnamese girls tended to disagree more strongly ($M = 3.48$) with the statement than did the non-Vietnamese girls ($M = 2.76$), $t(63) = 4.44$, $p < .001$.

No statistically significant difference was found between the way in which the Vietnamese and the non-Vietnamese girls perceived their fathers' attitude towards the girls as learners of mathematics, $t(59) = 1.47$, $p > .05$. But, again, when the girls responded to the statement "My father thinks advanced mathematics is a waste of time for me" (Item 5 on *Father* scale) there was a statistically significant difference in the students' responses (Table D6 in

Appendix D). The Vietnamese girls tended to disagree more strongly (M = 3.52) with the statement than did the non-Vietnamese girls (M = 2.78), $t(59) = 3.19$, $p < .001$. The mean scores for both the *Mother* (M = 38.77) and the *Father* (M = 38.46) scales for the Vietnamese girls were very similar. Likewise, the mean scores for both the *Mother* (M = 34.67) and the *Father* (M = 35.96) scales for the non-Vietnamese girls were similar (see Table 7).

Participation

The number of respondents who were enrolled in each of the senior secondary mathematics classes is shown in Table 8. For the dependent variable *Participation*, the difference in participation between all of the Vietnamese girls (M = 1.42) and all of the non-Vietnamese girls (M = 1.29) in the sample, $t(63) = 0.60$, $p > .05$, was not statistically significant.

The percentages of the Vietnamese girls (n = 26) and the non-Vietnamese girls (n = 39) with nil, low, medium and high levels of participation are compared in Figure 6. Participation levels are described in Table 6 in Chapter 5.

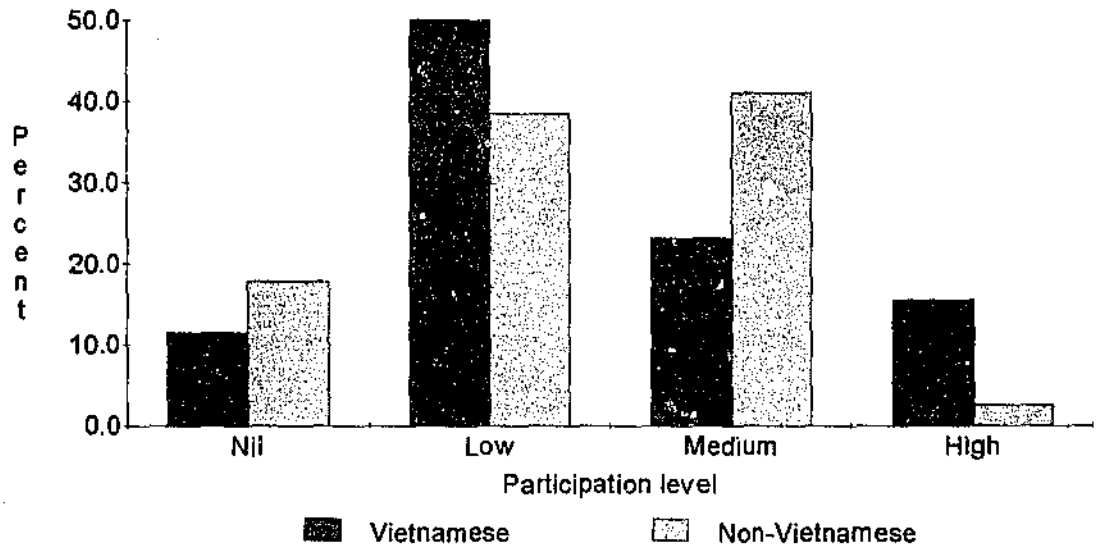

Figure 6. Percentages of Vietnamese (n = 26) and non-Vietnamese (n =39) respondents by participation level.

Table 8

Respondent Enrolments in Senior Secondary Mathematics Classes

Mathematics units	Vietnamese ($n = 26$)	Non-Vietnamese ($n = 39$)
Calculus	0	1*
Applicable Mathematics	1	1*
Discrete Mathematics	3	9
Modelling with Mathematics	6	5
No mathematics in Year 12	1	0
Geometry & Trigonometry	2*	0
Introductory Calculus	4*	0
Foundations of Mathematics	2	7
Maths in Practice	7	10
No mathematics in Year 11	2	7

* Contains students who are enrolled in two mathematics units.

Of the Vietnamese respondents (n = 26), 12% chose not to enrol in any mathematics unit compared with 18% of the non-Vietnamese respondents (n = 39). The participation rate for both groups at the low level was approximately the same with 12% more Vietnamese girls than non-Vietnamese girls participating at this level. However, 18% more non-Vietnamese than Vietnamese girls participated at the medium level but 14% of Vietnamese girls compared with 3% of non-Vietnamese girls participated at the highest level. There were no Vietnamese girls and only one non-Vietnamese girl studying Calculus in Year 12. There were four Vietnamese girls and no non-Vietnamese girls studying Geometry and Trigonometry, and Introductory Calculus (pre-

requisites for Year 12 Calculus) in Year 11. In 1995 there will be one Vietnamese girl and no non-Vietnamese girls studying Calculus in Year 12.

Of the total Years 11 and 12 female school population of 141, 18% did not enrol in any of the eight mathematics units on offer, 55% participated at the low level, 22% at the medium level and only 5% at the highest level. Units in the medium and high levels are available for students requiring TEE (University entrance) scores or for those Year 11 students who will undertake TEE studies in mathematics. Therefore, approximately 75% of the senior female school population limit their post-school options by not participating at the medium and high levels of mathematics.

Situational Variables

Age and the length of time in Australia for Vietnamese students have been described as situational variables. On average, Vietnamese girls are between 9 and 10 months older than non-Vietnamese girls in Years 11 and 12. Table 9 shows the mean ages of respondents by year level and ethnicity.

Table 9

Mean Age by Year Level and Ethnicity

Year	Vietnamese	Non-Vietnamese
11	17.3 ($n = 14$)	16.4 ($n = 24$)
12	18.2 ($n = 12$)	17.5 ($n = 15$)

There is a statistically significant difference between the ages of the Vietnamese girls ($M = 17.3$) and the non-Vietnamese girls ($M = 16.4$), $t(36) = 4.07$, $p < .01$ in Year 11. There also was a statistically significant difference between the ages of the Vietnamese girls ($M = 18.2$) and the non-Vietnamese girls ($M = 17.5$) in Year 12, $t(25) = 2.06$, $p < .05$.

All of the Vietnamese girls in the sample were born in Vietnam. Approximately 40% have been in Australia for less than 4 years, 20% between 4 and 6 years and 40% over 6 years. By comparison, 15% of non-Vietnamese girls in the sample were born overseas with only 5% being in Australia less than 6 years. Table 10 shows the percentage of each of the two groups according to the length of time in Australia.

Table 10

Length of Time in Australia for Vietnamese and Non-Vietnamese Students (as a percentage of the respective sub-samples)

	0–2 years	2–4 years	4–6 years	> 6 years
Non-Vietnamese	0.0	2.6	2.6	94.8
Vietnamese	3.9	34.6	19.2	42.3

Correlations

A correlation matrix was calculated for the six scales for Vietnamese and non-Vietnamese students to determine: (a) if there was any relationship between the components of the internal belief system for individuals within each group and their participation in mathematics; (b) if there was any relationship between the components of the external influences for individuals within each group and their participation in mathematics; and (c) if there was any association between the components of the internal belief system of the individuals within each group and the external factors associated with their mothers, fathers and teachers. The correlation matrix for the non-Vietnamese and the Vietnamese girls for the six scales, participation and age are presented in Table 11.

Table 11

Correlation Matrix for Non-Vietnamese Students (n = 39) and Vietnamese Students (n = 26)

	Vietnamese		Non-Vietnamese	
	Participation	Age	Participation	Age
Confidence	.16	-.36	.26	.18
Usefulness	.10	-.11	.44**	.07
Everyone	.09	-.40*	.09	.34*
Teacher	.26	-.07	.31	.09
Mother	-.19	.12	.23	.07
Father	.03	.26	.20	.17

* $p<.05$. ** $p<.01$.

Internal belief system and participation. The results indicate that the internal belief components for students in each group have little association with these students' participation in mathematics. *Usefulness* correlated much more strongly with *Participation* for the non-Vietnamese girls ($r = .44$, $p<.01$) than it did for the Vietnamese girls ($r = .10$, $p>.05$) even though the Vietnamese girls tended to believe that mathematics was more useful than did the non-Vietnamese girls (see Table 7).

External influences and participation. The results indicate that the external influence components for students in each group have little association with these students' participation in mathematics. Although the Vietnamese girls tended to perceive that their mothers had a positive attitude towards them as learners of mathematics, there was a negative correlation between the *Mother* scale and *Participation* ($r = -.19$, $p>.05$). The *Teacher* scale did not show a statistically

significant correlation with *Participation* for either the non-Vietnamese ($r = .31$, $p>.05$) or the Vietnamese students ($r = .26$, $p>.05$).

The difference between the correlation coefficients of the Vietnamese and the non-Vietnamese students (for any of the scales and *Participation* given in Table 11) was not found to be statistically significantly different from zero using Fisher's z_r transformations (see Table 12).

Table 12

Test of Significance Between Correlation Coefficients using Fisher's z_r transformation for Vietnamese (n = 26) and Non-Vietnamese (n = 39) Students

	Confidence	Usefulness	Everyone	Teacher	Mother	Father
Participation	0.40	1.39	0.00	0.21	1.60	0.65

The correlations between the components of each groups' internal belief system and the external influences are presented in Tables 13 and 14.

Table 13

Correlation Matrix for the Six Scales for Non-Vietnamese Students (n = 39)

	Confidence	Usefulness	Everyone	Teacher	Mother
Usefulness	.47**				
Everyone	.00	-.01			
Teacher	.41*	.36*	.19		
Mother	.48**	.56**	.03	.41**	
Father	.36*	.21	.20	.33*	.30

* $p<.05$. ** $p<.01$.

Table 14

Correlation Matrix for the Six Scales for Vietnamese Students (n = 26)

	Confidence	Usefulness	Everyone	Teacher	Mother
Usefulness	.21				
Everyone	.44*	.67**			
Teacher	.43*	.44*	.26		
Mother	.19	.55**	.38	.48*	
Father	.31	.69**	.64**	.36	.68**

* $p<.05$. ** $p<.01$.

External influences and the internal belief system. The external influences of teacher, mother and father are all associated with the girls' internal belief system but the strength of the association differs slightly for each group. For non-Vietnamese girls and Vietnamese girls alike, the strongest correlation with the components of the internal belief system was with their *Mother* scale. There was, however, a 20% difference between the Vietnamese and the non-Vietnamese girls in favour of the Vietnamese girls who reported that their mothers offered encouragement and support when responding to the open-ended question "How does she feel about you doing mathematics at school?" (see Table 21). For the non-Vietnamese girls, the *Mother* scale showed a statistically significant correlation with the *Confidence* scale ($r = .48$, $p<.01$) and the *Usefulness* scale ($r = .56$, $p < .01$). For the Vietnamese girls, the *Mother* scale correlated significantly with only the *Usefulness* scale ($r = .55$, $p<.01$).

The *Father* scale for the Vietnamese girls correlated much more strongly with the components of the internal belief system than for the non-Vietnamese girls. When responding to the open-ended question "What does your father say about the mathematics that you do?" only 27% of the Vietnamese girls reported that

their fathers thought that mathematics was important and useful compared with 38.5% for the non-Vietnamese girls (see Table 22). The majority of the non-Vietnamese and the Vietnamese girls reported that their fathers offered encouragement and support for them participating in mathematics at school.

For the Vietnamese girls, the *Father* scale showed a statistically significant correlation with the *Everyone* scale (r = .64, p < .01) and the *Usefulness* scale (r = .69, p < .01) but no significant correlations were found for the non-Vietnamese girls between the *Father* scale and the components of the internal belief system.

The *Teacher* scale for both the non-Vietnamese and the Vietnamese girls showed a statistically significant correlation with the components of the internal belief system (see Tables 13 and 14). Although the correlations were not strong (r = .36 to .44, p<.05), the relationships do indicate that positive teacher attitudes towards girls as learners of mathematics tend to be related to students' confidence and their perceptions about the usefulness of mathematics. Of the Vietnamese girls in the sample, 50% either did not know what their teachers' attitude towards them was or did not comment when given the opportunity to do so. The corresponding percentage for the non-Vietnamese girls was only 20% (see Table 20).

The difference between the correlation coefficients of the Vietnamese and the non-Vietnamese students (for *Usefulness* and *Everyone*) was found to be statistically significantly different from zero using Fisher's z_r transformations (z_r = 3.08, p<.01). These are shown in Table 15. Similar results were obtained with the correlation coefficients for *Father* and three other scales. The correlation coefficients for *Father* and *Usefulness* (z_r = 2.38, p<.05), *Father* and *Mother* (z_r = 1.96, p<.05), and *Father* and *Everyone* (z_r = 2.08, p<.05) scales for each group were also found to be statistically significantly different from zero.

Table 15

Test of Significance Between Correlation Coefficients using Fisher's z_r transformation for Vietnamese (n = 26) and Non-Vietnamese (n = 39) Students

	Confidence	Usefulness	Everyone	Teacher	Mother
Usefulness	1.13				
Everyone	1.77	3.08**			
Teacher	0.09	0.36	0.28		
Mother	1.24	0.06	1.39	0.03	
Father	0.21	2.38*	2.08*	0.13	1.96*

* $p<.05$. ** $p<.01$.

An examination of the scatter plot for the *Usefulness* score against the *Everyone* score for the non-Vietnamese girls (Figure 7) shows that non-Vietnamese girls who scored lower on the *Usefulness* scale tended to believe that girls are as good as boys in mathematics. This results in the low correlation between the two variables for the non-Vietnamese girls. In contrast, the scatter plot for the Vietnamese girls (Figure 8) shows that the Vietnamese girls who scored lower on the *Usefulness* scale tended to believe that girls cannot do as well in mathematics as boys, whereas the Vietnamese girls who scored higher on the *Usefulness* scale tended to believe that girls can do as well as boys in mathematics.

Open-ended Question Responses and Interview Data

The responses to the open-ended questions are given in Appendix E. Responses for the open-ended questions which were included at the end of the scales were grouped under common themes. The number of responses for each theme is given in Tables 16 and 18 to 22. Many students gave several responses

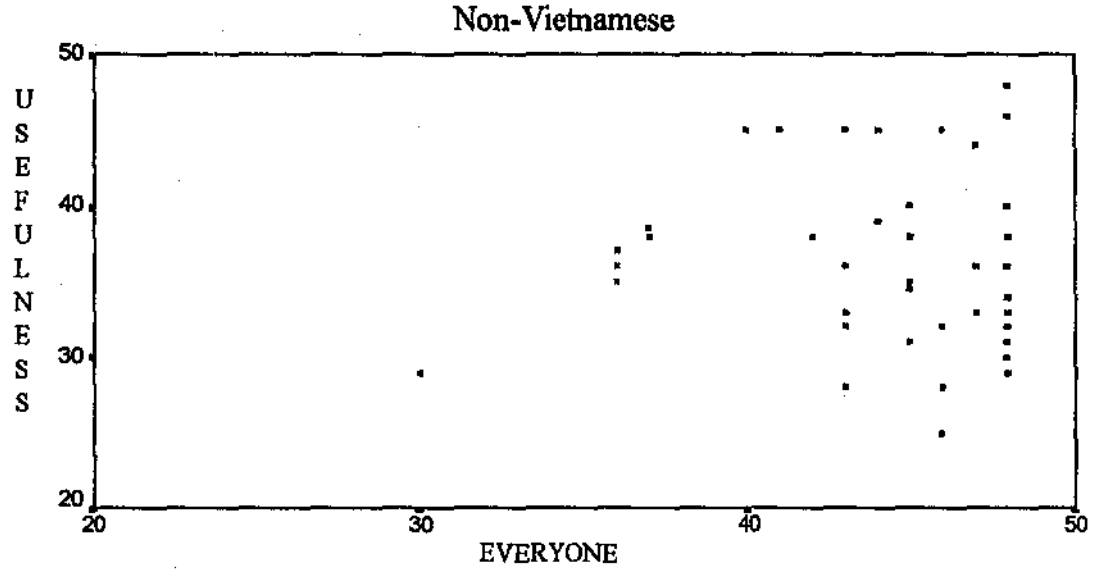

Figure 7. Scatter plot for *Usefulness* scale versus *Everyone* scale for the non-Vietnamese girls.

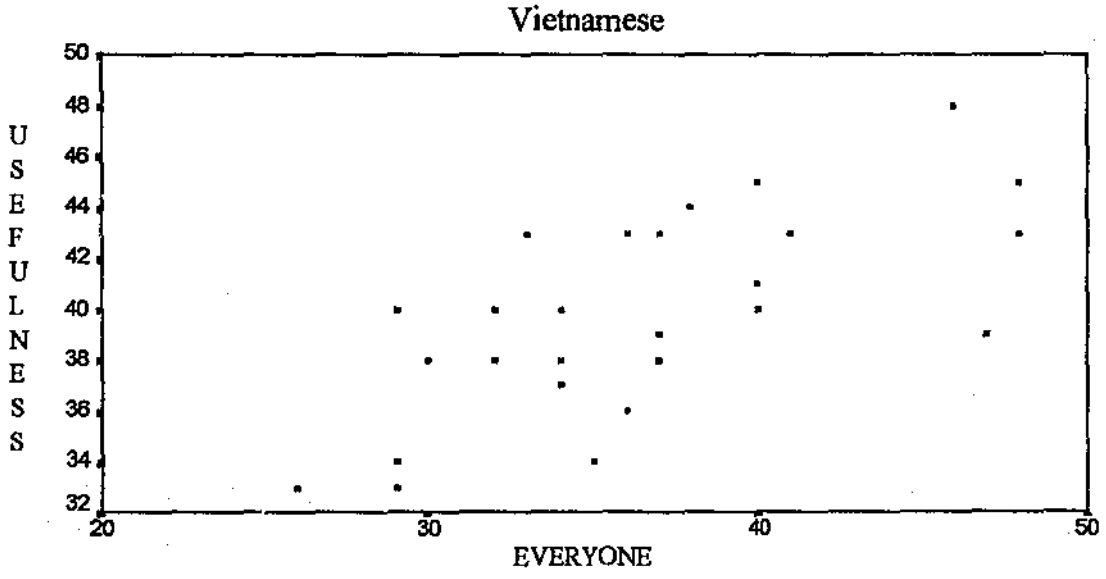

Figure 8. Scatter plot for *Usefulness* scale versus *Everyone* scale the for Vietnamese girls.

to each open-ended question, and each response was analysed and categorised separately. The total number of responses to a given open-ended question, therefore, usually exceeded the number of students giving the responses. Students who gave responses will be designated V01 to V26 for the Vietnamese girls and NV01 to NV39 for the non-Vietnamese girls.

Three Vietnamese and three non-Vietnamese students were interviewed and their responses will be given where appropriate. The girls who were interviewed were NV15, NV30, NV32, V08, V12, and V17, and these designations will be used in text. For the actual responses the interviewer will be designated "I" and the student responding will be designated "S."

Confidence. Although the Vietnamese girls tended to be more confident than the non-Vietnamese girls in learning mathematics, their responses to the question "How do you feel before doing a mathematics test or exam?" (Table 16) showed that they tended to be equally anxious before sitting for a mathematics test or exam.

Table 16

Responses to the Question "How do You Feel Before Doing a Mathematics Test or Exam?"

	Number of responses	
Themes from responses	Non-Vietnamese	Vietnamese
Confident	11 (28.2)	6 (23.1)
Anxious (including nervous, stressed, tense, frustrated, worried)	22 (56.4)	15 (57.7)
Not confident because of lack of ability	3 (7.7)	0 (0.0)
Anxious because of fear of failure	3 (7.7)	3 (11.5)
No comment	0 (0.0)	2 (7.7)

Note. The percentage of responses for each group is shown in parentheses.

A Chi-squared analysis of the data in the 2 x 2 matrix (Table 17) showed that there was no statistically significant difference in the category of confidence before sitting a mathematics test or exam between Vietnamese and non-Vietnamese girls [$\chi^2(1, N = 65) = 0.088, p>.05$].

The study did not examine mathematics anxiety. Mathematics anxiety has been described as similar and closely related to confidence (Leder, 1992). It appears, however, that the responses to the open-ended question may have revealed mathematics test anxiety rather than confidence in learning mathematics.

Table 17

Chi-Squared Matrix for Confidence and Ethnicity

	Non-Vietnamese	Vietnamese	Total
Confidence	11	6	17
Anxious / not confident	28	18	46
Total	39	24	63

Usefulness. Although the Vietnamese girls tended to feel that mathematics was more useful than the non-Vietnamese girls (see Table 7), 46% of the non-Vietnamese girls believed that mathematics was useful for everyday tasks and daily life compared with 15% of the Vietnamese girls in the sample. For example, a non-Vietnamese girl (NV04) responded:

> Mathematics is used in everyday life. It is just that we never notice it. Some of the formulas a bit far fetched but all the work in mathematics is useful.

In contrast, 65% of the Vietnamese girls believed that mathematics would be useful for their future occupations compared with 36% of the non-Vietnamese

girls in the sample (see Table 18). For example, a Vietnamese girl (V03) responded:

> I do need mathematics when finishing school, if I have a job, and go to work at a shop or somewhere else.

Table 18

Responses to the Question "If a Friend Asked You What Use Would Mathematics Be After Finishing School, What Would You Tell Her?"

	Number of responses	
Themes from responses	Non-Vietnamese	Vietnamese
Maths is useful for everyday tasks and daily life.	18 (46.2)	4 (15.4)
Maths is useful for future jobs.	14 (35.9)	17 (65.4)
Maths is useful for further education.	6 (15.4)	3 (11.5)
Maths is useful for solving problems	3 (7.7)	0 (0.0)
Maths is useful for teaching our children.	2 (5.1)	1 (3.8)
Maths is not very useful.	3 (7.7)	0 (0.0)
No comment	1 (2.6)	5 (19.2)

Note. The total number of responses is greater than the number of respondents because of multiple responses by some students. The percentage of responses for each group is shown in parentheses.

The Vietnamese girls tended to specify the occupations for which they felt mathematics was useful in contrast with the non-Vietnamese girls who simply commented that mathematics was useful. For example, a Vietnamese student (V09) wrote:

I would tell her that I need to work well at mathematics because I would like to work in a bank and you need to be good at maths if you want to be a bank teller.

One non-Vietnamese student (NV08) wrote:

It will help you get a job.

Few girls directly mentioned that mathematics was useful for their future education although some of the occupations mentioned did imply that further education was required. One non-Vietnamese student (NV32) associated further education and satisfaction when interviewed:

I: How much influence was the need to do maths on your decision (to participate)?

S: Big lots! I didn't want to cut out any options by cutting out maths or only doing a lower level maths unit. I get a lot of satisfaction out of doing maths and I think that I'll get the same level by doing science at Uni.

But another non-Vietnamese student (NV17) who did not participate in mathematics at all had the following to say when interviewed:

I: Although you have a positive attitude towards maths, you didn't choose to do it, why?

S: Maths has no place for what I want to do in the future.

I: What do you want to do then?

S: I want to work in welfare so I can work with people.

Everyone. Table 19 gives a clear indication that, in their written responses, the non-Vietnamese girls expressed strong beliefs that ability in mathematics is independent of gender. This is consistent with the *t*-test results in Table 7. Of

the Vietnamese respondents, 23% felt that boys were better at mathematics than girls compared with 5% for the non-Vietnamese girls.

Table 19

Responses to the Question "What Do You Think About the Question on Whether Boys or Girls are Better at Mathematics?"

	Number of responses	
Themes from responses	Non-Vietnamese	Vietnamese
Individual ability is independent of gender.	14 (35.9)	7 (26.9)
Boys and girls are equally as good.	17 (43.6)	4 (15.4)
The question is sexist.	8 (20.5)	1 (3.8)
Boys are better than girls.	2 (5.1)	6 (23.1)
Girls need more encouragement.	3 (7.7)	0 (0.0)
Males are given more opportunity.	1 (2.6)	0 (0.0)
The question is irrelevant.	2 (5.1)	2 (7.7)
No comment	0 (0.0)	6 (23.1)

Note. The total number of responses is greater than the number of respondents because of multiple responses by some students. The percentage of responses for each group is shown in parentheses.

The statements made by the Vietnamese girls tended to be qualified and did not go into the same depth as the statements from the non-Vietnamese girls. For example:

> I think that girls can do maths as good as boys but usually boys are a bit better than girls. (Student V08)

or

> I think boys and girls are good at maths but when they are in Uni, I think boys are better than girls because they try very hard. (Student V14)

Two of the Vietnamese respondents believed that males may have an innate ability to do mathematics but that the males were lazy when it came to mathematics. For example:

> I think the boys are very intelligent about mathematics but they very lazy when solve the mathematics problems. And girls are not intelligent like boys but they work hard to solve the problem in mathematics. (Student V19)

On the whole, the Vietnamese girls in the sample tended to believe that, if they worked hard at mathematics, they could achieve as well as the boys. The following is a typical statement from a Vietnamese girl (V13).

> I think girls are just as good as boys in mathematics if they are prepared to do the work.

For Vietnamese girls there could be other mitigating factors, as the following excerpt from an interview with student V12 suggests:

> I: You said girls can do maths just as well as boys.
>
> S: Yes, they can. Some don't try or are scared of it.
>
> I: Is that all girls or just Vietnamese girls?
>
> S: Especially Vietnamese girls.
>
> I: Why?
>
> S: Because they have trouble with the language and don't speak up about things that they don't understand. It doesn't stop them from doing higher level maths, it's just one of the factors that contribute to it.

During the interviews, the girls were asked whether they would prefer single-sex or mixed-sex classes. The five who were doing mathematics all agreed that they would prefer a mixed-sex class if the boys were task-oriented and did not disturb them with off-task behaviour during class. As one Vietnamese girl (V17) succinctly described the situation:

I: Would you prefer a single-sex class?

S: Not really. I'd prefer a mixed-sex class but without the animals in it. If everybody there was willing to learn, it would be fine.

The girls were happy in an environment in which they could learn.

Teacher. On the *Teacher* scale (see Table 7) no statistically significant difference was found between the means for the Vietnamese and the non-Vietnamese students. However, the responses to the open-ended question "How would your teacher describe you as a learner of mathematics?" revealed that 41% of the non-Vietnamese girls perceived that their teachers believed that they had ability but needed to work harder at mathematics (see Table 20). In contrast, no Vietnamese girls gave this response.

For example, one non-Vietnamese girl (NV38) wrote:

> She has the ability to do well at maths if only she practised just a bit more. She needs to apply herself more to achieve a higher and more deserved grade.

During her interview, one non-Vietnamese student (NV30) indicated that she believed that teacher gender made a difference.

I: How do you find your teacher's attitude towards you as a learner of mathematics being a girl?

S: No different. I've got a female teacher?

I: What about past teachers? Have they treated you differently?

S: Male teachers have tended to show more concern.

I: Why?

S: They saw that I was OK at mathematics and gave lots of encouragement and support to keep going and they explained more.

Table 20

Responses to the Question "How Would Your Teacher Describe You as a Learner of Mathematics?"

	Number of responses	
Themes from responses	Non-Vietnamese	Vietnamese
Good at mathematics	4 (10.3)	4 (15.4)
Capable or average student	9 (23.1)	4 (15.4)
Has ability but needs to work harder	16 (41.0)	0 (0.0)
Hardworking	3 (7.7)	6 (23.1)
Not good at mathematics	1 (2.6)	0 (0.0)
Do not know	6 (15.4)	6 (23.1)
No comment	2 (5.1)	7 (26.9)

Note. The total number of responses is greater than the number of respondents because of multiple responses by some students. The percentage of responses for each group is shown in parentheses.

About half of the Vietnamese girls did not know what their teacher thought of them as learners of mathematics or chose not to respond to the question "How would your teacher describe you as a learner of mathematics?". Those who responded all felt that the teacher viewed them in a positive light in that they were hard working, capable or good at mathematics. For example:

Enthusiastic, hard working and considerate student in class. (V17)

The Vietnamese girls who were interviewed found that neither their gender nor their ethnicity hindered them in mathematics. A typical exchange from student V12 is given in the following interview extract:

I: Any support from teachers?

S: Yes, they see that I'm good at maths and so have encouraged me to try harder and do my best. If you build up a nice relationship with your teacher, they understand you more and help you more.

I: Ever had a problem in maths because of your gender or ethnicity?

S: No. I get on alright with the guys. Every now and then a word will pop up that I don't understand so I'll just ask. Some Vietnamese girls are too scared to ask.

For both the Vietnamese and non-Vietnamese girls, statistically significant correlations were found between the *Teacher, Confidence* and *Usefulness* scales (see Tables 13 and 14).

Mother. The majority of the Vietnamese and the non-Vietnamese respondents felt that their mothers offered them encouragement and support in their mathematical endeavours (see Table 21). The support and encouragement for one non-Vietnamese girl (NV32) was described as having a long history:

I: What was the biggest influence on your decision to participate at the high level you do?

S: It goes back to when I was a child. Even before I started school. Mum gave me lots of puzzles and maths things to solve so when I started school, I was already interested in it. I was always very good at maths in primary school. It was a bit boring for me in high school but

when I had to decide at the end of Year 10, I chose to do the highest level maths because I was good at it and very interested in it.

Table 21

Responses to the Question "What Does Your Mother Say About the Mathematics That You Do and How Does She Feel About You Doing Mathematics at School?"

	Number of responses	
Themes from responses	Non-Vietnamese	Vietnamese
Offers encouragement and support	24 (61.5)	21 (80.8)
Mathematics is important and useful	10 (25.6)	4 (15.4)
Could do mathematics at a higher level	5 (12.8)	1 (3.8)
Could do better	5 (12.8)	2 (7.7)
Happy with my own decision	5 (12.8)	0 (0.0)
Says nothing or does not care	8 (20.5)	4 (15.4)
Does not understand the mathematics that I do	5 (12.8)	2 (7.7)
Mathematics is a waste of time.	1 (2.6)	0 (0.0)
No comment	2 (5.2)	5 (19.2)

Note. The total number of responses is greater than the number of respondents because of multiple responses by some students. The percentage of responses for each group is shown in parentheses.

The mothers of the Vietnamese girls were perceived to have a more positive attitude towards their daughters as learners of mathematics than their non-Vietnamese counterparts. As can be seen in Table 21, approximately 20% more Vietnamese girls than non-Vietnamese girls indicated that their mothers offered

encouragement and support to them as learners of mathematics. However, 15% of the Vietnamese girls felt that their mothers did not care or say anything about their mathematics participation in school. There were 8% of the Vietnamese girls who believed that their mothers did not understand the mathematics that they did at school.

Although 25% of the non-Vietnamese girls indicated that their mothers stated that mathematics was important and useful, only 15% of the Vietnamese girls did likewise. This corresponds to data presented in Table 18 where 46% of the non-Vietnamese girls thought that mathematics was useful for everyday tasks and daily life compared with 15% for the Vietnamese girls.

Of the non-Vietnamese girls, 13% perceived that their mothers were happy with their daughters' decision to participate in mathematics but no similar responses were offered by the Vietnamese girls (see Table 21).

The Vietnamese girls who were interviewed indicated that their parents worked hard and long to support the family and did not have the time or inclination to show much interest. Their parents' lack of education also contributed to the lack of interest as indicated in the following excerpt from an interview with a Vietnamese student (V12):

I: Do you receive any parental support at home?

S: They're not interested at all. They don't ask about it (school) at all.

I: Why?

S: They don't understand what's going on. They both left school before they finished primary school, so they have no idea about the education system.

I: Did you help your sister choose her units for high school?

S: Yes, my parents left everything up to me.

I: Even without much support at home, you have managed to do very well in mathematics, why is that?

S: I'm very energetic and enthusiastic and want to do well in life. I don't want to be like my parents and work from 6.00am - 11.00pm every day.

Ethnicity appears to play an important part in how the non-Vietnamese girls perceived their mothers' attitude, as the following responses indicate:

> She doesn't really say anything because she studied in Burma and wasn't able to go on to high school. (Student NV05)

and

> My mum is Japanese and she thinks it's a waste of time. (Student NV25)

An interview with a non-Vietnamese student (NV30) gives a similar picture:

> My mum is Lebanese and she is supportive but if I come home with 30/31 (for a maths test) she says I could have done better. If I come home with 31/31 she says that's nice dear. If I do badly, she tells me off but if I do good, she doesn't care.

Such perceptions are not confined only to students of Asian background.

> Because she's from New Zealand, she says that it (maths) has developed quite a lot and that she was unable to do the highest level at her school so she doesn't have a clue as much as she wants to. (Student NV15)

The educational background of the girls' mothers appear to influence their perceived attitudes towards their daughters.

Father. Written responses to the question "What does your father say about the mathematics that you do and how does he feel about your doing mathematics at school?" are summarised in Table 22.

Table 22

Responses to the Question "What Does Your Father Say About the Mathematics That You Do and How Does He Feel About You Doing Mathematics at School?"

	Number of responses	
Themes from responses	Non-Vietnamese	Vietnamese
Offers encourage and support	24 (61.4)	19 (73.1)
Mathematics is important and useful	15 (38.5)	7 (26.9)
Could do mathematics at a higher level	7 (18.0)	0 (0.0)
Could do better	3 (7.7)	0 (0.0)
Happy with my own decision	5 (12.8)	0 (0.0)
Says nothing or does not care	7 (18.0)	5 (19.2)
Does not understand the mathematics that I do	1 (2.6)	2 (7.7)
Mathematics is a waste of time	1 (2.6)	0 (0.0)
No comment	3 (7.7)	7 (26.9)

Note. The total number of responses is greater than the number of respondents because of multiple responses by some students. The percentage of responses for each group is shown in parentheses.

The majority of respondents felt that their fathers offered them encouragement and support in their mathematical endeavours. For example, from a non-Vietnamese girl (NV14):

> He thinks much the same as mum. That it is very important to do maths for your future career. He thinks it's very good because he knows that I have the potential to do very well in maths

and from a Vietnamese girl (V04):

Same as my mother. As long as I do well he will be happy to hear. He also feels happy about the maths that I do at school because he knows how useful it will be for me in daily life.

It is interesting to note the similarities between the girls' responses to the open-ended questions about how their mothers and fathers feel about their daughters doing mathematics at school.

No statistically significant difference was found between the perceived fathers' attitude towards their daughters as learners of mathematics for the Vietnamese and non-Vietnamese girls [t (59) = 1.66, $p > .05$] (see Table 7). Although 39% of the non-Vietnamese girls responded that their fathers thought that mathematics was important and useful, only 27% of Vietnamese girls responded in a similar way (see Table 22). This can be compared with the responses to the question "If a friend asked you what use would mathematics be after finishing school, what would you tell her?" (see Table 18) where 46% of the responses from non-Vietnamese girls indicated that the girls thought that mathematics was useful for everyday tasks and daily life compared with 15% of responses from the Vietnamese girls.

Although the written responses indicated that 13% of the non-Vietnamese girls felt that their fathers were happy with their daughters' decision to participate, no similar responses were forthcoming from the Vietnamese girls. However, 26% of Vietnamese girls and 20% of non-Vietnamese girls felt that their fathers did not care about or understand the mathematics that they did at school. Typical responses include:

He doesn't say anything and doesn't care. (Student NV06)

or

He has no opinion and as long as I do well, he doesn't care. (Student V12)

Many responses to the questions "What does your mother/father say about the mathematics that you do at school and how does she/he feel about you doing

mathematics at school?" from the Vietnamese and the non-Vietnamese girls were similar. For example, from a non-Vietnamese student (NV10):

> Same as mum. Do good and I'll be happy. He wants me to do good in all my subjects and he just wants me to do whatever I'm good at.

and from a Vietnamese student (V04):

> Same as my mother. As long as I do well (in whatever I'm doing, he will be happy. At least he knows that I know how to work out simple daily life sums like shopping lists, budgets etc.

When responding to the "mother/father" question, 18% of the non-Vietnamese girls reported that their fathers thought that they could do mathematics at a higher level whereas 13% of the non-Vietnamese girls reported that their mothers thought likewise. For example:

> He thinks mathematics is very important and that I should try and learn as many subjects of mathematics as I can. He believes the better and more you do in maths the bigger the choice of getting a good job. He is upset at the moment because he feels I am not using my full potential. (NV03)

Only one similar response was forthcoming from a Vietnamese student when responding to the "mother" question.

Conclusion

The use of the open-ended questions and subsequent interviews has yielded a rich source of important information. In some cases it has indicated possible reasons for a relationship between variables whereas in others it has shown that there are differences within a particular attitudinal variable when the differences did not appear in the initial analysis. The results of the study will be discussed in Chapter 7 along with limitations and implications of the study.

Chapter 7

Discussion

This chapter, where possible, compares the results of the present study with previous research and discusses the findings in relation to the generic model adopted. Direct comparison between the results of this study and previous studies, however, is difficult. Previous studies have focused on gender rather than ethnic differences in attitudes towards mathematics (see, for example, Fennema & Sherman, 1976, 1977, 1978). Large scale meta-analyses by Hyde, Fennema and Lamon (1990), and Hyde et al. (1990) reported that ethnicity was recorded for only 2–7% of individuals in the samples cited.

Each of the research questions will be examined, followed by a discussion of the limitations and then the conclusions and implications of the study. The results of the present study will be discussed only in terms of the sample used, and no attempt will be made to generalise the results of the study. Throughout the discussion, particular areas for future research in the affective domain and its relationship to mathematics learning will be suggested.

Attitudes Towards Mathematics

The study used six sub-scales of the Fennema-Sherman *Mathematics Attitude Scales* (1976), open-ended questions and interview data to measure affective components and external influences in relation to mathematics learning for Vietnamese and non-Vietnamese senior secondary female students. The data was analysed to determine whether attitudinal variables differed between the Vietnamese and the non-Vietnamese female students in the sample.

Most studies of Vietnamese students in Australia have focused on the attitudes of Vietnamese students towards education in general (O'Brien, 1990)

and on the difficulties they faced integrating into a new educational system (Hartley & Maas, 1987). A careful search of the literature suggests that this is the first time that a research study has focused on the attitudes towards mathematics of female Vietnamese students.

Internal belief system. Although *t*-tests on the data obtained from the *Confidence* scale indicated that there was a statistically significant difference between the responses of the Vietnamese girls compared with those of the non-Vietnamese girls (Table 7), a Chi-squared analysis of their responses to the open-ended question "How do you feel just before doing a mathematics test or exam?" showed that there was no statistically significant difference between the two groups in their responses to this question. An examination of these responses revealed that just over half of both Vietnamese and non-Vietnamese girls in the sample felt anxious (Table 16).

This anxiety was also described by the girls as nervousness, stress, tension, frustration and worry. Those students who scored high on the *Confidence* scale did not report anxiety in the response to the open-ended question but those who did report anxiety scored low on the *Confidence* scale. Fennema and Sherman (1976) argued that mathematics anxiety is nothing more than lack of confidence in learning mathematics and reported strong correlations between measures assessing confidence in mathematics and anxiety. Likewise, in a study of university students, Relich, Way and Martin (1994) presented evidence which suggested that mathematics anxiety and confidence were not different constructs. The evidence presented in the present study tends to confirm this view although no distinction is made between mathematics anxiety, test anxiety or simple mathematics test anxiety. Future studies of this type would need to design appropriate instruments to differentiate between mathematics anxiety, test anxiety or mathematics test anxiety. The students interviewed reported that they only felt nervous before a mathematics test when they felt that they had not

studied hard enough or did not like the content at the time. They reported similar feelings about other subjects.

The Vietnamese girls, as a group, scored higher on the *Usefulness* scale than the non-Vietnamese girls (Table 7). Their responses to the open-ended question "If a friend asked you what use would mathematics be after finishing school, what would you tell her" suggested that the Vietnamese girls tended to believe that mathematics was more useful for future jobs and careers than did the non-Vietnamese girls. In contrast, the non-Vietnamese girls tended to believe that mathematics was more useful for everyday tasks and daily life than did the Vietnamese girls (Table 18). It was interesting to note, however, that there was a statistically significant correlation between the response data on the *Usefulness* and *Participation* scales for the non-Vietnamese girls but not for the Vietnamese girls.

According to the vast majority of the non-Vietnamese girls, mathematics is an activity that everyone can do, irrespective of gender. They believed very strongly that individual ability is independent of gender and that males and females are equally as good at mathematics. The difference between the means on the *Everyone* scale for the Vietnamese and the non-Vietnamese girls was equally statistically significant for both Year 12 [$t(25) = 4.70$, $p < .001$] and for Year 11 [$t(36) = 3.58$, $p < .001$]. Educators need to be aware that ethnic differences may mean that some of their female students hold beliefs that mathematics ability is dependent on gender. As previous studies have shown (see, for example, Fennema & Sherman, 1977), this could place these students at an educational disadvantage by acting as a mediating variable affecting, for example, confidence and/or perception of the usefulness of mathematics.

External influences. Parents of both groups of girls were reported as offering encouragement and support for their daughters' participation in post-compulsory mathematics (Tables 21 and 22). Ethington (1992) noted that females perceiving

greater encouragement from parents were likely to consider mathematics less difficult, and that this, in turn, meant that higher levels of achievement were attained. The non-Vietnamese girls, to a greater degree than the Vietnamese girls, tended to perceive that their parents believed that mathematics was more important and useful for their daughters.

Stamp (1979) noted that, in choosing what subjects to study at school, girls are influenced by the parent of the stereotypical appropriate gender—that is, fathers for mathematics and mothers for languages. Conversely, girls are more likely to identify with a mother who liked mathematics. In this study, most of the Vietnamese students *strongly disagreed* with the statement "My mother/father hates to do mathematics" for *both* their mothers and fathers. In contrast, most of the non-Vietnamese girls tended to *disagree* with the same statement (Tables D5 and D6).

Because of their parents' work commitments, educational attainment and language, 25% of the Vietnamese girls in the sample felt that their parents either said nothing, did not care about or did not understand their participation in mathematics. Hartley and Maas (1987) also reported that Vietnamese parents worked long hours which necessitated a change in family roles. This study confirmed that the parents of the Vietnamese students in the sample did work long hours and that their daughters had to share a greater responsibility in the running of the family. As one Vietnamese girl (V17) said when interviewed:

> Most Vietnamese people are too busy with work. I have to do everything at home and look after my brother and sister and try to fit in school work and the two days per week that I do work experience. It is a bit much sometimes but I'm coping so far.

Family responsibilities and culturally different expectations of female household roles may affect their education and post-school options.

The means on the *Teacher* scale for the Vietnamese and non-Vietnamese students were not statistically significantly different (Table 7). Over 40% of the non-Vietnamese girls perceived that their teachers believed that they had the ability but needed to work harder at mathematics to fulfil their potential. The majority of Vietnamese girls (54%) felt that their teachers would describe them as good, hardworking students. Because of the high respect that teachers in Vietnam are accorded (Hartley & Maas, 1987; Toan, 1989), Vietnamese students, on the whole, want to give a good impression to their teachers. One Vietnamese girl (V12), when interviewed, said "If you build up a nice relationship with your teacher, they understand and help you more." Understanding and relationships are important, as another Vietnamese girl (V08) reported:

I: How long have you been in Australia?

S: 3 years.

I: You speak very good English, I can understand you easily.

S: Maybe you try to understand more than other people.

Relationship Between the Internal Belief System and External Influences

The internal belief components and the external influences of teacher, mother and father of each group showed little association with the girls' participation in mathematics except that *Usefulness* correlated much more strongly with *Participation* for the non-Vietnamese girls than it did for the Vietnamese girls (Table 11). The external factors of teacher, mother and father are all associated with at least one component of the girls' internal belief systems but the strength and nature of components involved in the association differs slightly for the Vietnamese and non-Vietnamese students (Tables 13 and 14).

The model which underpins this research proposes that external influences impinge on the internal belief system (affect component) of the girls as well as on mediating learning activities. The learning behaviours are then directly associated

with the educational outcome of participation. The study has confirmed that there is a strong relationship between the external influences and the internal belief system of the Vietnamese and non-Vietnamese girls. In particular, statistically significant correlations were found between *Mother* and *Confidence*, and *Mother* and *Usefulness* for the non-Vietnamese students (see Table 13). For the Vietnamese students, a statistically significant correlation was also found between *Mother* and *Usefulness*, as well as between *Father* and *Usefulness*, and *Father* and *Everyone* (see Table 14). The model proposes an intervening factor —mediating learning activities—which influences the learning behaviours in the mathematics classroom such as task preference, task persistence and working on tasks independently.

Mediating Learning Activities

Although the study did not directly examine learning activities, data was collected via interviews on certain learning behaviours which Fennema and Peterson (1985), and Beahan (1992) found to be associated with achievement and participation in mathematics. These behaviours were described as choice of task and task persistence, independent learning and success in mathematics.

Five of the girls who were interviewed were participating in varying levels of mathematics. All the girls were asked if they were given a choice between an interesting and challenging mathematics problem and an easy, strictly routine one, which would they choose and why? All said that they would choose the challenging one although one Vietnamese girl (V12) said she would do both of them, the second one for fun. The reasons for doing so included enjoying a challenge, it would be interesting and it's something new. All described themselves as persistent when confronted with a mathematical challenge. For example, from a non-Vietnamese girl (NV32) who participates at the highest level:

I'd work until I got it out. It wouldn't worry me how long it took. I get great satisfaction from getting out hard problems

or from a Vietnamese girl (V12) with high participation but not confident:

I am very persistent. I get frustrated if a can't do a problem. If the worse comes to worse I would just have to ask the teacher.

Similarly, from a Vietnamese girl (V17) with low participation but very confident:

I am persistent because the harder it is, the more you'd want to work it out.

The Vietnamese girls who were interviewed all said that they preferred to work in a group so that a number of different points of view could be discussed whereas the non-Vietnamese girls preferred to work alone. The feeling of success experienced on solving a challenging mathematical problem was described in the following view of one Vietnamese girl:

I: How would you feel if you got the problem out after an hour?

S: Great!! Knowing that I sat down, looked at the problem, tried to work it out and finally getting it out makes me feel as if I've accomplished something. (Student V17)

The five girls who were participating in mathematics were interviewed; they all scored high on the *Usefulness* scale.

The responses to questions concerning choice of task, task persistence and whether the respondents would prefer to work in a group when participating in mathematical problem-solving activities were responses to a hypothetical situation. Observed behaviours might be significantly different if the girls were monitored in the actual practice of mathematical problem-solving activities, and future research in this area could prove fruitful.

Situational Variables

The study also examined a number of situational variables. These included age, length of time in Australia and socio-economic background. On average the Vietnamese girls in the sample were between 9 and 10 months older than the non-Vietnamese girls (Table 9).

There was a statistically significant correlation between *Age* and the *Everyone* scale for both the Vietnamese (r = -.40, p < .05) and the non-Vietnamese girls (r = .34, p<.05) (see Table 11). The results indicate that the older non-Vietnamese girls tended to believe that boys and girls were equally as good at mathematics whereas, in contrast, the older Vietnamese girls did not. As discussed earlier, the older Vietnamese girls tended to have been in Australia less time than their younger peers so this perception may change with increased exposure to the education system and wider society in Australia.

Participation

Despite the generally low socio-economic background of the community in which the school is located, the participation rates of its students in senior high school compare favourably with participation rates for Government schools across Western Australia and nationally. Table 23 shows the percentage of Year 11 and 12 students attending the school (for both males and females), and also presents corresponding percentages for secondary school students in W.A. and in Australia (Australian Bureau of Statistics, 1993b). The results indicate that a higher percentage of female Year 11 students attend this school compared with the State and National average. The percentage of Year 12 females from the school in which the study took place is slightly lower than the State average but equivalent to the National average. Figures for the males in Years 11 and 12 of the school population in which the study took place show that their numbers are below the State average but above the National average.

Table 23

Comparison of the Number of Year 11 and 12 Students as a Percentage of the Total School Population for the Present Study, Government Schools Across Western Australia and Nationally

		Female			Male	
Year	School	W. A.	Australia	School	W. A.	Australia
11	9.2	9.0	8.2	8.7	9.5	8.1
12	7.4	8.0	7.4	7.2	7.7	6.8

Despite the comparable senior secondary participation rates for males and females, participation rates in higher levels of mathematics show wide differences. At present, in the sample school, 0.9% of students studying mathematics in Year 12 are females studying Calculus. This should be compared with 4% of students who were female and studied Calculus in 1993 in Western Australia. Again, at present in the sample school, 2.5% of students studying mathematics are females taking Introductory Calculus and Geometry and Trigonometry in Year 11. This compares with 18% in 1993 for Western Australian Year 11 females studying Introductory Calculus and Geometry and Trigonometry (Secondary Education Authority, 1994). Further research is needed to elucidate possible reasons why so few female students participate in higher levels of mathematics at the school.

A comparison between the various components of the students' internal belief system, and external influences for this and previous studies is given in Table 24. Table 24 also gives the means and standard deviations of the six scales used in the present study and the previous studies undertaken by Fennema and Sherman (1976), and Sherman (1979) which were undertaken among high school students in the U.S.A. Means for all respondents in Years 11 and 12 on the *Usefulness,*

Table 24

Means and Standard Deviations of Mathematics Attitude Scales for the Present Study, Fennema and Sherman (1976) and Sherman (1979)

		Year	Confidence	Usefulness	Everyone	Teacher	Mother	Father
Present study	non-Vietnamese	11	35.29 (12.22)	44.92 (8.09)	54.58 (5.49)	48.04 (6.32)	43.46 (8.25)	43.91 (9.84)
		12	40.53 (11.02)	48.03 (7.01)	57.13 (3.96)	48.20 (8.50)	42.80 (10.45)	46.67 (10.62)
	Vietnamese	11	46.29 (6.91)	50.57 (4.72)	46.64 (7.95)	49.64 (6.76)	49.13 (4.20)	48.82 (6.68)
		12	40.17 (7.69)	40.75 (5.33)	43.92 (9.21)	45.58 (6.58)	49.08 (5.55)	49.00 (5.64)
	All respondents	11	39.34 (11.77)	47.00 (7.49)	51.66 (7.48)	48.63 (6.44)	45.35 (7.59)	45.50 (9.14)
		12	40.37 (9.51)	48.80 (6.81)	51.26 (9.44)	47.04 (7.68)	45.59 (9.05)	47.70 (8.69)
Fennema-Sherman	Females	10	42.12 (9.58)	46.62 (7.57)	55.34 (4.24)	41.00 (8.08)	44.74 (7.57)	44.55 (8.29)
		11	42.50 (9.58)	46.77 (6.49)	54.93 (4.43)	42.66 (7.11)	44.77 (6.94)	46.50 (7.95)
		12	48.21 (6.43)	49.97 (7.45)	52.26 (4.88)	44.35 (7.06)	45.65 (7.72)	48.11 (7.55)
Sherman	Females	10	43.28 (9.03)	45.87 (8.83)	53.47 (5.63)	42.55 (6.84)	44.29 (7.57)	45.27 (7.55)
		11	45.26 (8.38)	48.18 (7.71)	53.74 (5.78)	44.42 (6.67)	45.89 (7.57)	46.53 (7.81)
		12	48.37 (5.43)	49.67 (6.49)	52.87 (5.71)	44.80 (5.62)	46.23 (8.09)	46.47 (9.18)

Note. Students in Years 11 and 12 of the present study are approximately the same age as students in Years 10 and 11 from the Fennema and Sherman (1976) and Sherman (1977) studies. Standard deviations are shown in parentheses.

Everyone, *Mother* and *Father* scales in the present study are similar to those found in the previous studies. The means on the *Confidence* scale are lower for the present study but the means on the *Teacher* scale are higher in the present study than those found in the Fennema and Sherman (1976), and Sherman (1979) studies. It must be noted, however, that the girls in the present study had participated in a minimum of 3 years compulsory mathematics whereas mathematics participation in high school in the U.S.A. is not compulsory. Any differences may reflect prior differential course enrolments.

Limitations

The limited size of the sample used in this study and the fact that all students came from one metropolitan senior high school, does not allow for any generalisation of the results. The attitudes measured in the present study are specific to mathematics and cannot be seen as enduring traits of personality.

Potential problems associated with any reticence to participate in the study on the part of the Vietnamese girls were allayed by having the researcher, who was an accepted member of the school community, administer the questionnaires to all students. The use of pre-determined items, open-ended questions and interviews for data collection provided triangulation of the data.

Although all Vietnamese students were born in Vietnam and Vietnamese was the main language spoken at home, no ethnic categorisation was determined for non-Vietnamese students. All students bring to the classroom prior educational experiences, as well as attitudes, beliefs and emotions which will be influenced by their home culture.

The non-Vietnamese students in the study represented approximately 30 different ethnic backgrounds. Because of the scope and time limit of the study, only the girls' perceived attitudes of their parents towards them as learners of mathematics could be measured and no consideration could be given to determine the attitudes of parents towards their daughters from the parents themselves. Further research on ethnic differences on attitudes towards mathematics needs to

examine actual parental attitudes and beliefs, and the influence provided by their home culture.

The scope of the study did not allow an examination of other affective variables within the internal belief system, such as attributional style and motivation, and within the external influences, such as peers and school environment, nor did it allow an examination of the interaction between the affective or cognitive domain.

Conclusions and Implications

Little relationship was found between *Participation* and the components of each group's internal belief system. Similarly, little relationship was found between *Participation* and the external influences of mother, father and teacher (see Table 11). However, the external influences of mother, father and teacher had a statistically significant relationship with some of the components of each groups' internal belief system. Several results are of particular interest. For example, nearly all of the non-Vietnamese girls, irrespective of their confidence and/or perception of the usefulness of mathematics, strongly believed that mathematical ability was independent of gender. In contrast, most of the Vietnamese girls who scored lower on the *Confidence* and *Usefulness* scales held the more stereotypical belief that males and females did not have the same ability in mathematics but most of the Vietnamese girls who scored higher on these scales, also believed, like their non-Vietnamese peers, that mathematical ability was independent of gender.

The proposed theoretical model (see Figure 4) shows an "affect" component made up of confidence, usefulness and gender-role stereotyping. The results tend to indicate that the "affect" component requires a further reinterpretation in relation to Vietnamese female students. For example, the model could be modified to show a delineation between *confidence* and *mathematics anxiety* for each ethnic group being studied. The model could also be modified to show the

usefulness component separated into *everyday/daily life* and *further education/employment* components.

Some suggestions for future research have been made where appropriate throughout the discussion. For example, research on ethnic differences on attitudes towards mathematics needs to examine actual parental attitudes and beliefs. The influence provided by students' home culture also needs to be examined. Further studies on the factors influencing students' decisions to participate in post-compulsory mathematics need to include Year 10 students. The students in the present study had already made the decision whether or not to participate, and at what level, in mathematics.

There has been a surfeit of studies examining gender differences in mathematics attitude and participation but because of the increasing multi-culturalisation of our high schools, further studies should examine any gender differences in terms of ethnicity.

Between 1981 and 1991 there was a three fold increase in the percentage of Vietnamese in Western Australia (Australian Bureau of Statistics, 1993c). Vietnamese children who arrive in Western Australia differ in their previous educational experiences and socio-economic background. The difficulties of integrating into a new society are compounded when people differ from prevailing norms in expectations, language and culture. The education of students from different cultural backgrounds should be such that no disadvantage arises from ethnicity or gender and that all students achieve optimal educational outcomes.

The relationship between gender, ethnicity, attitudes towards mathematics and participation in mathematics appears to be a complex one in which many factors are influential. Educational practices should take account of not only the factors which influence attitudes towards mathematics but should also recognise that the mathematics classroom does not contain a homogeneous group of students but a complex sociometric mix of unique individuals.

REFERENCES

Ainley, J., Jones, W., & Navaratnam, K. K. (1990). *Subject choice in senior secondary school.* Canberra: Commonwealth Government Printer.

Andrich, D. (1982). Using latent trait measurement models to analyse attitudinal data: a synthesis of viewpoints. In D. Spearritt (Ed.), *The improvement of measurement in education and psychology* (pp. 89-126). Hawthorn, Victoria: Australian Council for Educational Research

Armstrong, J. M. (1980). *Achievement and participation of women in mathematics.* Denver, CO: Education Commission of the States.

Australian Association of Mathematics Teachers. (1990). *A national statement on girls and mathematics.* Adelaide: Author.

Australian Education Council. (1991). *A national statement on mathematics for Australian schools.* Carlton, VIC: Curriculum Corporation.

Australian Bureau of Statistics. (1993a). *Perth: A social atlas* (Catalogue No. 2840.5), Canberra: Author

Australian Bureau of Statistics. (1993b). *1993 Schools Australia* (Catalogue No. 4221.0). Canberra: Author.

Australian Bureau of Statistics. (1993c). *1993 Western Australian Yearbook* (Catalogue No. 1300.5). Canberra: Author.

Barnes, M., Plaister, R., & Thomas, A. (1984). *Girls count in maths and science.* Darlinghurst, NSW: Mathematical Association of New South Wales.

Barr, R. (1988). Conditions influencing content taught in the fourth-grade mathematics classrooms. *The Elementary School Journal, 88*(4), 387-411.

Bar-Tal, D. (1978). Attributional analysis of achievement-related behaviour. *Review of Educational Research, 48*(2), 259-271.

Beahan, L. (1992). *Sex-related differences in autonomous learning behaviours and mathematics achievement.* Unpublished honours thesis, Edith Cowan University, Perth, W.A.

Bee, H. (1989). *The developing child* (5th ed.). New York: Harper & Row.

Bell, A. W., Costello, J., & Kuchemann, D. E. (1989). *A review of research in mathematical education Part A.* Canberra: NFER-Nelson.

Biggs, J. (1989). Students' approaches to learning in Anglo-Chinese schools. *Educational Research Journal, 4,* 8-17.

Bradley, D., & Bradley, M. (1984). *Problems of Asian students in Australia: Language, culture and education.* Canberra: Australian Government Publishing Service.

Buxton, L. (1981). *Do you panic about maths?* London: Heinmann.

Clark, C. M., & Peterson, P. L. (1986). Teachers' thought processes. In M. C. Wittrock (Ed.), *Handbook of research on teaching* (3rd ed., pp. 255-296). New York: Macmillan.

Cobb, P., Yackel, E., & Wood, T. (1989). Young children's emotional acts during mathematical problem solving. In D. B. McLeod & V. M. Adams (Eds.), *Affect and mathematical problem solving: A new perspective* (pp. 117-148). New York: Springer-Verlag.

Coon, D. (1986). *An introduction to psychology: Exploration and application* (4th ed.). St. Paul, MN: West Publishing Co.

Cunningham, G. K. (1986). *Educational and psychological measurement.* New York: MacMillan Publishing Company.

DuBois, B., & Burns, J. A. (1975). An analysis of the meaning of the question mark response category in attitude scales. *Educational and Psychological Measurement, 35,* 869-884.

Eccles, J., Adler, T. F., Futterman, R., Goff, S. B., Kaczala, C. M., Meece, J. L., & Midgley, C. (1985). Self-perceptions, task perceptions, socialising influences, and the decision to enrol in mathematics. In L. R Brush & D. M. Wilson (Eds.), *Women and mathematics: Balancing the equation* (pp. 95-121). Hillsdale, NJ: Lawrence Erlbaum.

Eccles, J., & Jacobs, J. E. (1986). Social forces shape math attitude and performance. *Signs, 11,* 367-380.

Ellerton, N. F., & Clements, M. A. (1994). *Fostering mathematical attitudes and appreciation.* Adelaide: Australian Association of Mathematics Teachers.

Ethington, C. A. (1992). Gender differences in a psychological model of mathematics achievement. *Journal for Research in Mathematics Education, 23*(2), 166-181.

Ethington, C. A., & Wolfle, L. M. (1984). Sex differences in a causal model of mathematics achievement. *Journal for Research in Mathematics Education, 15*, 361-377.

Fennema, E. (1981). *Girls, women and mathematics: An overview.* Madison, WI: University of Wisconsin.

Fennema, E. (1989). The study of affect and mathematics: A proposed generic model for research. In D. B. McLeod & V. M. Adams (Eds.), *Affect and mathematical problem solving: A new perspective* (pp. 205-219). New York: Springer-Verlag.

Fennema, E., & Peterson, P. L. (1985). Autonomous learning behaviour: A possible explanation of gender-related differences in mathematics. In L. C. Wilkinson & C. B. Marrett (Eds.), *Gender-related differences in classroom interaction* (pp. 17-35). New York: Academic Press.

Fennema, E., & Sherman, J. (1976). Fennema-Sherman Mathematics Attitude Scales: Instruments designed to measure attitudes toward the learning of mathematics by females and males. *JSAS: Catalog of Selected Documents in Psychology, 6*(2), 31. Washington, DC: American Psychological Association.

Fennema, E., & Sherman, J. (1977). Sex-related differences in mathematics achievement, spatial visualisation and sociocultural factors. *American Educational Research Journal, 14*, 51-71.

Fennema, E., & Sherman, J. (1978). Sex-related differences in mathematics achievement and related factors: A further study. *Journal for Research in Mathematics Education, 9*, 189-206.

Fennema, E., Wolleat, P., & Pedro, J. D. (1979). Mathematics Attribution Scale. *JSAS: Catalog of Selected Documents in Psychology, 9*(5), 26. Washington, DC: American Psychological Association.

Fox, L. H., Tobin, D., & Brody, L. (1979). Sex role socialisation and achievement in mathematics. In M. A. Wittig & A. C. Peterson (Eds.), *Sex-related differences in cognitive functioning* (pp. 303-327). New York: Academic Press.

Grouws, D. A., & Cramer, K. (1989). Teaching practices and student affect in problem-solving lessons of select junior high mathematics teachers. In D. B. McLeod & V. M. Adams (Eds.), *Affect and mathematical problem solving: A new perspective* (pp. 149-161). New York: Springer-Verlag.

Hart, L. E. (1989). Describing the affective domain: Saying what we mean. In D. B. McLeod & V. M. Adams (Eds.), *Affect and mathematical problem solving: A new perspective* (pp. 37-48). New York: Springer-Verlag.

Hartley, R., & Maas, F. (1987). *Getting a lot further...Some factors influencing decisions which ethnic families make about children's schooling and post-school futures.* Melbourne: Australian Institute of Family Studies.

Hau, K. T., & Salili, F. (1991). Structure and semantic differential placement of specific causes: Academic causal attributions by Chinese students in Hong Kong. *International Journal of Psychology, 26*, 175-193.

Hyde, S. H., Fennema, E., & Lamon, S. J. (1990). Gender differences in mathematics performance: A meta-analysis. *Psychological Bulletin, 107*, 139-155.

Hyde, S. H., Fennema, E., Ryan, M., Frost, L. A., & Hopp, C. (1990). Gender comparisons of mathematics attitudes and affect. *Psychology of Women Quarterly, 14*, 299-324.

Jones, W. (1988). Entry to engineering, technology, and science in higher education. *Occasional Paper no. 20.* Hawthorn, VIC: Australian Council for Educational Research.

Kim, J., & Kahout, F. (1975). *SPSS.* New York: McGraw-Hill.

Kloosterman, P. (1990). Attributions, performance following failure, and motivation in mathematics. In E. Fennema & G. C. Leder (Eds.), *Mathematics and gender* (pp. 96-127). New York: Teachers College Press.

Kulm, G. (1980). Research on mathematics attitude. In R. J. Shumway (Ed.), *Research in mathematics education* (pp. 356-387). Reston, VA: National Council of Teachers of Mathematics.

Leder, G. C. (1987). Attitudes towards mathematics. In T. A. Romberg & D. M. Stewart (Eds.), *The monitoring of school mathematics* (Vol. 2, pp. 261-277). Madison, WI: Wisconsin Center for Education Research.

Leder, G. C. (1990). Gender differences in mathematics: An overview. In E. Fennema & G. C. Leder (Eds.), *Mathematics and gender* (pp. 10-26). New York: Teachers College Press.

Leder, G. C. (1992). Mathematics & gender: Changing perspectives. In D. A. Grouws (Ed.), *Handbook of research on mathematics teaching and learning* (pp. 597-622). New York: MacMillan Publishing Company.

Leder, G. C., Fullarton, S., & Taylor, P. (1994). Mathematically gifted students: Challenging the stereotype. *Australian Senior Mathematics Journal, 8*(2), 13-19.

Lester, F. K., Garofalo, J., & Kroll, D. L. (1989). Self-confidence, interest, beliefs, and metacognition: Key influences on problem-solving behaviour. In D. B. McLeod & V. M. Adams (Eds.), *Affect and mathematical problem solving: A new perspective* (pp. 3-19). New York: Springer-Verlag.

Lovejoy, F. H., & Barboza, E. (1984). Feminine mathematics anxiety: A culture-specific phenomenon. In R. Burns & B. Sheehan (Eds.), *Women and education (pp. 141-150).* Bundoora, VIC: La Trobe University.

Mandler, G. (1989). Affect and learning: Causes and consequences of emotional interactions. In D. B. McLeod & V. M. Adams (Eds.), *Affect and mathematical problem solving: A new perspective* (pp. 3-19). New York: Springer-Verlag.

Marcelo, C. (1987). *A study of implicit theories and beliefs about teaching in elementary school teachers.* Paper presented at the Symposium "Studies of teachers' thinking in action" at the annual meeting of the American Educational Research Association, Washington. ERIC document ED281835.

Marshall, H. H. (1987). Motivational strategies of three fifth-grade teachers. *The Elementary School Journal, 88*(2), 135-149.

McLeod, D. B. (1989). Beliefs, attitudes and emotions: New views of affect in mathematics education. In D. B. McLeod & V. M. Adams (Eds.), *Affect and mathematical problem solving: A new perspective* (pp. 244-258). New York: Springer-Verlag.

McLeod, D. B. (1992). Research on affect in mathematics education : A reconceptualization. In D. A. Grouws (Ed.), *Handbook of research on mathematics teaching and learning* (pp. 597-622). New York: MacMillan Publishing Company.

Meyer, M. R., & Koehler, M. S. (1990). Internal influences on gender differences in mathematics. In E. Fennema & G. C. Leder (Eds.), *Mathematics & gender* (pp. 60-95). New York: Teachers College Press.

Middleton, J. A., Webb, N. L., Romberg, T. A., & Pittelman, S. D. (1990). *Teachers' conceptions of mathematics and mathematics education.* Madison, WI: Wisconsin Center for Education Research.

O'Brien, C. (1990). Influences on career choices of Vietnamese girls. In Western Australian Ministry of Education (Ed.), *Gender, ethnicity & class: The career crunch for girls from non-English speaking backgrounds* (pp. 59-61). Perth, W. A.: Editor.

Pedro, J. D., Wolleat, P., Fennema, E., & Becker, A. D. (1981). Election of high school mathematics by females & males: Attributions and attitudes. *American Educational Research Journal, 18*(2), 207-218.

Perl, T. H. (1982). Discriminating factors on sex differences in electing mathematics. *Journal for Research on Mathematics Education, 13*, 66-74.

Peterson, P. L., Fennema, E., Carpenter, T. P., & Loef, M. (1989). Teachers' pedagogical content beliefs in mathematics. *Cognition and Instruction, 6*(1), 1-40.

Ponte, J. P., Matos, J. F. Guimaraes, H. M., Leal, L. C., & Canavarro, A. P., (1994) Teachers' and students' views and attitudes towards a new mathematics curriculum: a case study. *Educational Studies in Mathematics, 26*, 347-365.

Poole, C. (1982). Reactant statement. In D. Spearritt (Ed.), *The improvement of measurement in Education and Psychology* (pp. 127-128). Hawthorn, VIC: Australian Council for Educational Research.

del Popolo, S., & Shannon, A. G. (1987). Some aspects of mathematical under achievement in secondary education. *International Journal of Mathematics Education in Science and Technology, 18*(2), 165-175.

Relich, J., Way, J., & Martin, A. (1994). Attitudes to teaching mathematics: Further development of a measuring instrument. *Mathematics Education Research Journal, 6*(1), 56-69.

Reyes, L. H. (1984). Affective variables and mathematics education. *The Elementary School Journal, 84*(5), 558-581.

Reynolds, A. J., & Walberg, H. J. (1992). A process model of mathematics achievement and attitude. *Journal for Research in Mathematics Education, 23*(4), 306-328.

Rowe, K. J. (1988). Single-sex and mixed-sex classes: The effects of class type on student achievement, confidence and participation in mathematics. *Australian Journal of Education, 32*(2), 180-202.

Schoenfeld, A. (1989). Explorations of students' mathematical beliefs and behaviour. *Journal of Research in Mathematics Education, 20*(4), 338-355.

Secondary Education Authority (1994). *Secondary education statistics 1993.* Perth, W.A.: Author.

Sherman, J. (1979). Predicting mathematics performance in high school girls and boys. *Journal of Educational Psychology, 71*(2), 242-249.

Simon, H. A. (1982). Comments. In M. S. Clark & S. T. Fiske (Eds.), *Affect and cognition* (pp. 333-342). Hillsdale, NJ: Lawrence Erlbaum.

Stamp, P. (1979). Girls and mathematics: Parental variables. *British Journal of Educational Psychology, 49*, 39-50.

Stocking, V. B., & Goldstein, D. (1992). Course selection and performance of very high ability students: Is there a gender gap? *Roeper Review, 15*(1), 48-51.

Toan, Do Quy (1989). Notes on education in the traditional culture of Vietnam. *Journal of Vietnamese Studies, 1*(2), 13-16.

Weiner, B. (1974). *Achievement motivation and attribution theory.* Morristown, NJ: General Learning Press.

Weiner, B. (1984). Principles of a theory of student motivation and their application within an attributional framework. In R. E. Ames & C. Ames (Eds.), *Motivation in education. Vol. 1: Student motivation* (pp. 15-38). Orlando, FL: Academic Press.

Weiner, B. (1986). *An attributional theory of motivation and emotion.* New York: Springer-Verlag.

Western Australian Ministry of Education. (1991a). *Social justice in education: Policy and guidelines for gender equity.* Perth, W.A.: Author.

Western Australian Ministry of Education. (1991b). *Social justice in education: Policy and guidelines for the education of non-English speaking background students.* Perth, W.A.: Author.

Willis, S. (1989). *Real girls don't do maths: Gender and the construction of privilege.* Geelong, VIC: Deakin University.

Wolleat, P. L., Pedro, J. D., Becker, A. D., & Fennema, E. (1980). Sex differences in high school students' causal attributions of performance in mathematics. *Journal for Research in Mathematics Education, 11*, 356-366.

Wong, K. Y., & Herrington, T. (1992). Research in learning strategies in mathematics. In B. Attache & J. Watson (Eds.), *Research in mathematics education in Australasia 1988-1991* (pp. 129-142). Brisbane: Mathematics Education Research Group of Australasia.

Woolfolk, A. E. (1990). *Educational psychology* (4th ed.). Englewood Cliffs, NJ: Prentice-Hall Inc.

Appendix A

Attitudes towards mathematics survey
(English version)

Confidential | **Code:**

ATTITUDES TOWARDS MATHEMATICS

SURVEY

Name: _____ **Form:** _____

The purpose of this study is to survey your attitudes towards mathematics.

You are free to withdraw from the study at any time.

All answers will be treated in the strictest confidence, and only a summary of the information gathered (with no names) will be used to write up the report. I will be interviewing about six girls to gather more detailed information on students' attitudes towards mathematics and their decisions to enrol in particular units.

Confidential

Code:

ATTITUDES TOWARDS MATHEMATICS

SURVEY

Year: ☐ 11 ☐ 12

Length of time at Girrawheen Senior High School: ☐ years ☐ months

Previous time spent at other High Schools in Australia: ☐ years ☐ months

Were you born in Australia? ☐ yes ☐ no **Date of Birth:** ☐

If born overseas: Country of birth ☐

Length of time in Australia: ☐ years ☐ months

What language is mainly spoken at home?
Please tick one box

English ☐

Vietnamese ☐

Other ☐

Mathematics units:
Which units have you completed or are currently studying?
Please tick the appropriate boxes.

Year 11	Year 12
☐ **Geometry & Trigonometry**	☐ **Calculus**
☐ **Introductory Calculus**	☐ **Applicable Mathematics**
☐ **Mathematics in Practice**	☐ **Discrete Mathematics**
☐ **Foundations of Mathematics**	☐ **Mathematic Modelling**

1 **Confidence in mathematics**

Directions: On this questionnaire you are asked to put a cross (X) on each statement, corresponding to the extent to which you agree with each statement.

Statement	Strongly agree	Agree	Disagree	Strongly disagree
Example: I think that I am better at mathematics than other subjects.				
1. I am sure that I can learn mathematics.				
2. I have a lot of self-confidence when it comes to mathematics.				
3. Most subjects I can handle O.K., but I keep doing poorly at mathematics.				
4. Generally, I have felt safe about trying mathematics.				
5. I think I could handle more difficult mathematics.				
6. For some reason, even though I study, mathematics seems unusually hard for me.				
7. I am no good at mathematics.				
8. I do not think I could do advanced mathematics.				
9. I am not the type to do well in mathematics.				
10. I am sure I could do advanced work in mathematics.				
11. I can get good marks in mathematics.				
12. Mathematics has been my worst subject.				

How do you feel just before doing a mathematics test or exam? Try to write a sentence or two describing how you feel.

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2 **Usefulness of mathematics**

Directions: On this questionnaire you are asked to put a cross (X) on each statement, corresponding to the extent to which you agree with each statement.

Statement	Strongly agree	Agree	Disagree	Strongly disagree
Example: I think that mathematics is useful.				
1. I will need mathematics for my future work.				
2. Mathematics is of no relevance to my life.				
3. Knowing mathematics will help me get a good job.				
4. Mathematics will not be important to me in my life's work.				
5. I will need to be good at mathematics for my future work.				
6. I expect to have little use for mathematics when I leave high school.				
7. I see mathematics as a subject I will rarely use in my daily life as an adult.				
8. Mathematics is a worthwhile and necessary subject.				
9. I study mathematics because I know how useful it is.				
10. Doing mathematics at school is a waste of time.				
11. In terms of my adult life it is not important for me to do well in mathematics at high school.				
12. I will use mathematics in many ways as an adult.				

If a friend asked you what use would mathematics be after finishing school, what would you tell her?

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3

Can everyone do mathematics?

Directions: On this questionnaire you are asked to put a cross (X) on each statement, corresponding to the extent to which you agree with each statement.

Statement	Strongly agree	Agree	Disagree	Strongly disagree
Example: I think that everyone should do mathematics at school.				
1. Females are as good as males in geometry.				
2. Mathematics is for men; arithmetic is for women.				
3. It is hard to believe a female could be a genius in mathematics.				
4. When a women has to solve a mathematical problem, it is feminine to ask a man for help.				
5. Males are naturally better than females in mathematics.				
6. Women certainly are logical enough to do well in mathematics.				
7. I would trust a women just as much as I would trust a man to figure out important calculations.				
8. Girls who enjoy studying mathematics are a bit peculiar.				
9. I would have more faith in the answer for a mathematics problem solved by a man than a women.				
10. Girls can do just as well as boys in mathematics.				
11. Studying mathematics is just as appropriate for women as it is for men.				
12. I would expect a women mathematician to be a masculine type of person.				

What do you think about the question on whether boys or girls are better at mathematics?

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4 My teacher's attitude towards me as a learner of mathematics

Directions: On this questionnaire you are asked to put a cross (X) on each statement, corresponding to the extent to which you agree with each statement.

Statement	Strongly agree	Agree	Disagree	Strongly disagree
Example: I think my teacher enjoys mathematics				
1. My teachers have encouraged me to study more mathematics.				
2. My teacher thinks I am the type of person who could do well in mathematics.				
3. When it comes to anything serious, I have felt ignored when talking to mathematics teachers.				
4. I have found it hard to win the respect of mathematics teachers.				
5. My teachers have been interested in my progress in mathematics.				
6. Getting a mathematics teacher to take me seriously has usually been a problem.				
7. Mathematics teachers have made me feel that I have the ability to go further in mathematics.				
8. I have a hard time getting teachers to talk seriously with me about mathematics.				
9. My teachers think advanced mathematics is a waste of time for me.				
10. I would talk to my mathematics teachers about a career which uses mathematics.				
11. My teachers would think I wasn't serious if I told them I was interested in a career in science and mathematics.				
12. My mathematics teachers would encourage me to enrol in as many mathematics subjects that I could.				

How would your teacher describe you as a learner of mathematics?

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5 My mother's attitude towards me as a learner of mathematics

Directions: On this questionnaire you are asked to put a cross (X) on each statement, corresponding to the extent to which you agree with each statement.

Statement	Strongly agree	Agree	Disagree	Strongly disagree
Example: My mother likes mathematics.				
1 My mother thinks I could be good at mathematics.				
2. My mother thinks advanced mathematics is a waste of time for me.				
3. As long as I have passed, my mother hasn't cared how I have done in mathematics.				
4. My mother has strongly encouraged me to do well in mathematics				
5. My mother has shown no interest in whether or not I take more mathematics subjects.				
6. My mother thinks that mathematics is one of the most important subjects that I have studied.				
7. My mother has always been interested in my progress in mathematics.				
8. My mother wouldn't encourage me to plan a career which involved mathematics.				
9. My mother thinks I am the type of person who could do well in mathematics.				
10. My mother thinks I will need mathematics for what I want to do after I finish high school.				
11. My mother thinks that I need to know just the minimum amount of mathematics.				
12. My mother hates to do mathematics.				

What does your mother say about the mathematics that you do at school?

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How does she feel about your doing mathematics at school?

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6 My father's attitude towards me as a learner of mathematics

Directions: On this questionnaire you are asked to put a cross (X) on each statement, corresponding to the extent to which you agree with each statement.

Statement	Strongly agree	Agree	Disagree	Strongly disagree
Example: My father likes mathematics.				
1. My father thinks that mathematics is one of the most important subjects that I have studied.				
2. My father wouldn't encourage me to plan a career which involved mathematics.				
3. My father has always been interested in my progress in mathematics.				
4. My father thinks I will need mathematics for what I want to do after I finish high school.				
5. My father thinks advanced mathematics is a waste of time for me.				
6. My father has shown no interest in whether or not I take more mathematics subjects.				
7. My father has strongly encouraged me to do well in mathematics.				
8. My father hates to do mathematics.				
9. As long as I have passed, my father hasn't cared how I have done in mathematics.				
10. My father thinks I could be good at mathematics.				
11. My father thinks that I need to know just the minimum amount of mathematics.				
12. My father thinks I am the type of person who could do well in mathematics.				

What does your father say about the mathematics that you do at school?

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How does he feel about your doing mathematics at school?

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Appendix B

Attitudes towards mathematics survey
(Vietnamese version)

Hồ sơ mật

Mật mã

GIÁM ĐỊNH NHỮNG QUAN NIỆM VỀ TOÁN

KHẢO SÁT

Tên: _____ **Lớp:** _____

Mục đích của sự nghiên cứu này là để giám định những quan niệm của bạn về toán.

Bạn được tự do rút lại từ sự nghiên cứu bất cứ lúc nào.

Tất cả câu trả lời sẽ được giữ một cách bí mật, và chỉ một bản tóm lược của những tin tức thu được (không tên) sẽ được dùng để viết bản tường trình. Tôi sẽ phỏng vấn khoảng sáu nữ sinh thập thêm chi tiết tin tức trên những quan niệm về toán của học sinh và quyết định của họ để vào trong những đơn vị riêng.

GIÁM ĐỊNH NHỮNG QUAN NIỆM VỀ TOÁN

KHẢO SÁT

Lớp: ☐ 11 ☐ 12

Thời gian học ở Trường Trung học Girrawheen: ☐ **năm** ☐ **tháng**

Thời gian trước học ở các Trường Trung Học khác ở Úc: ☐ **năm** ☐ **tháng**

Bạn sinh ở Úc? ☐ **phải** ☐ **không** **Ngày sanh:** ☐

Nếu sinh ở ngoại quốc: **Sinh quán** ☐

Thời gian ở Úc: ☐ **năm** ☐ **tháng**

Ngôn ngữ chính nói ở nhà là gì?
Xin vui lòng đánh vào một ô.

Anh ngữ ☐

Việt Nam ☐

Ngôn ngữ khác ☐

Những đơn vị toán:
Đơn vị nào đã học xong hay đang học?
Xin vui lòng đánh vào ô thích hợp.

Year 11	Year 12
☐ **Geometry & Trigonometry**	☐ **Calculus**
☐ **Introductory Calculus**	☐ **Applicable Mathematics**
☐ **Mathematics in Practice**	☐ **Discrete Mathematics**
☐ **Foundations of Mathematics**	☐ **Mathematic Modelling**

1

Tin tưởng vào toán

Hướng dẫn: Trong câu hỏi này bạn được yêu cầu đánh một dấu chéo (X) trên mỗi xác ngôn tươn ứng tới khoảng mà bạn đồng ý với mỗi xác ngôn.

Xác ngôn	Hoàn toàn đồng ý	Đồng ý	Không đồng ý	Hoàn toàn không đồng
Thí dụ: Tôi nghĩ rằng tôi khá toán hơn những môn khác.				
1. Tôi chắc chắn rằng tôi có thể học toán.				
2. Tôi có nhiều tự tin khi đối diện với toán.				
3. Hầu hết những môn học tôi có thể nắm vững, nhưng tôi vẫn dở ở môn toán.				
4. Đại khái, tôi cảm thấy chắc chắn về học toán.				
5. Tôi nghĩ tôi có thể làm những bài toán khó hơn.				
6. Trong vài lý do, dầu tôi có học, toán dường như ít khó đối với tôi.				
7. Tôi không giỏi toán.				
8. Tôi không nghĩ tôi có thể học advanced mathematics.				
9. Tôi không phải là loại khá toán.				
10. Tôi chắc chắn rằng tôi có thể làm trước những bài toán.				
11. Tôi có thể đạt điểm cao trong môn toán.				
12. Toán là một môn dở nhất của tôi.				

Bạn cảm thấy như thế nào trước khi thử hay thi toán? Thử viết một hay hai câu miêu tả bạn cảm thấ như thế nào.....

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2

Sự ích lợi của môn Toán học

Hướng dẫn: Trong câu hỏi này bạn được yêu cầu đánh một dấu chéo (X) trên mỗi xác ngôn tư ứng tới khoảng mà bạn đồng ý với mỗi xác ngôn.

Xác ngôn	Hoàn toàn đồng ý	Đồng ý	Không đồng ý	Hoàn toà không đồn
Thí dụ: Tôi nghĩ rằng toán thì hữu dụng.				
1. Tôi sẽ cần toán cho công việc tương lai của tôi.				
2. Toán thì không liên hệ đến đời tôi.				
3. Biết toán sẽ giúp tôi nhận được việc tốt.				
4. Toán sẽ không quan trọng tới công việc của đời tôi.				
5. Tôi sẽ cần giỏi toán cho cho công việc tương lai của tôi.				
6. Tôi tin có dùng một ít toán khi rời trung học.				
7. Tôi thấy toán là một môn tôi sẽ ít khi dùng trong đời sống hằng ngày của tôi khi trưởng thành.				
8. Toán là một môn quan trọng và cần thiết.				
9. Tôi học toán bởi vì tôi biết nó rất hữu dụng.				
10. Học toán ở trường là phí thời gian.				
11. Trong đời sống trưởng thành của tôi nó không quan trọng cho tôi để học toán khá ở trung học.				
12. Tôi sẽ sử dụng toán trong nhiều trường hợp khi trưởng thành.				

Nếu một người bạn hỏi bạn toán sẽ dùng gì sau khi học xong, bạn sẽ nói sao với cô ấy?

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3 Tất cả mọi người có thể học môn Toán không?

Hướng dẫn: Trong câu hỏi này bạn được yêu cầu đánh một dấu chéo (X) trên mỗi xác ngôn tương ứng tới khoảng trống mà bạn đồng ý với mỗi xác ngôn.

Xác ngôn	Hoàn toàn đồng ý	Đồng ý	Không đồng ý	Hoàn toàn không đồng ý
Thí dụ: Tôi nghĩ rằng mọi người sẽ học toán ở trường.				
1. Nữ giới thì giỏi hình học cũng như nam giới.				
2. Toán học thì dành cho đàn ông; số học thì dành cho đàn bà.				
3. Khó mà tin rằng một người phụ nữ có thể là một thiên tài trong toán học.				
4. Khi một người đàn bà phải giải một vấn đề toán, người đàn bà thường nhờ người đàn ông giúp đỡ.				
5. Nam thì tự nhiên khá hơn nữ về toán.				
6. Đàn bà thì chắc chắn đủ hợp lý để học khá toán.				
7. Tôi sẽ tin một người đàn bà cũng nhiều như tôi sẽ tin một người đàn ông tính những phép tính quan trọng.				
8. Con gái thích học toán là một ít cá nhân.				
9. Tôi sẽ có thêm niềm tin trong sự giải đáp cho một vấn đề toán đã được giải bởi một người đàn ông hơn một người đàn bà.				
10. Con gái có thể học toán khá cũng như con trai.				
11. Học toán thì thích hợp cho đàn bà cũng như cho đàn ông.				
12. Tôi tin rằng người phụ nữ giỏi Toán là người có tánh nam phái.				

Bạn nghĩ gì về câu hỏi con trai hay con gái thì khá toán ?

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4

Những quan niệm của thầy tôi đối với tôi như một người học toán

Hướng dẫn: Trong câu hỏi này bạn được yêu cầu đánh một dấu chéo (X) trên mỗi xác ngôn tương ứng tới khoảng mà bạn đồng ý với mỗi xác ngôn.

Xác ngôn	Hoàn toàn đồng ý	Đồng ý	Không đồng ý	Hoàn toàn không đồng ý
Thí dụ: Tôi nghĩ rằng thầy tôi thích toán.				
1. Thầy tôi đã khuyến khích tôi học thêm toán.				
2. Thầy tôi nghĩ tôi là loại người có thể khá toán.				
3. Khi đối diện với những điều hệ trọng, tôi cảm thấy không để tâm đến thầy toán.				
4. Tôi thấy khó được lòng tôn trọng đối với thầy toán.				
5. Thầy tôi thích thú trong sự tiến bộ của tôi về toán.				
6. Tìm thầy toán để chỉ dẫn cho tôi một cách tận tâm luôn luôn là một vấn đề.				
7. Thầy toán đã làm tôi cảm thấy rằng tôi có khả năng học xa hơn trong môn toán.				
8. Tôi khó tìm thầy để nói chuyện một cách tận tâm về toán.				
9. Thầy tôi nghĩ rằng advanced mathematics là phí thời gian cho tôi.				
10. Tôi sẽ nói với thầy toán của tôi về một nghề mà sử dụng toán.				
11. Thầy của tôi sẽ nghĩ tôi không hệ trọng nếu tôi nói họ tôi thích một nghề nghiệp trong khoa học và toán.				
12. Thầy toán của tôi sẽ khuyến khích tôi ghi danh càng nhiều môn toán mà tôi có thể.				

Thầy của bạn cho rằng bạn như một người học toán như thế nào?

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5

Những quan niệm của mẹ tôi đối với tôi như một người học toán

Hướng dẫn: Trong câu hỏi này bạn được yêu cầu đánh một dấu chéo (X) trên mỗi xác ngôn tương ứng tới khoảng mà bạn đồng ý với mỗi xác ngôn.

Xác ngôn	Hoàn toàn đồng ý	Đồng ý	Không đồng ý	Hoàn toàn không đồng ý
Thí dụ: Mẹ tôi thích toán.				
1. Mẹ tôi nghĩ tôi có thể giỏi toán.				
2. Mẹ tôi nghĩ advanced mathematics là phí thời gian cho tôi.				
3. Miễn là tôi đậu, mẹ tôi không có lo tôi đã học toán như thế nào.				
4. Mẹ tôi đã mạnh mẽ khuyến khích tôi học khá toán.				
5. Mẹ tôi đã bày tỏ không thích thú rằng tôi có nên học thêm những môn toán hay không.				
6. Mẹ tôi nghĩ rằng toán là một trong những môn quan trọng nhất mà tôi đã học.				
7. Mẹ tôi luôn luôn thích thú trong sự tiến bộ về toán của tôi.				
8. Mẹ tôi sẽ không khuyến khích tôi để hoạch định một nghề mà có dùng toán trong đó.				
9. Mẹ tôi nghĩ rằng tôi là một loại người có thể khá toán.				
10. Mẹ tôi nghĩ tôi sẽ cần toán cho những gì tôi muốn làm sau khi tôi học xong trung học.				
11. Mẹ tôi nghĩ rằng tôi cần biết chỉ một số ít toán thôi.				
12. Mẹ tôi ghét học toán.				

Mẹ của bạn nói gì về toán mà bạn học ở trường?

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Bà ấy cảm thấy thế nào về sự học toán của bạn ở trường?

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6

Những quan niệm của cha tôi đối với tôi như một người học toán

Hướng dẫn: Trong câu hỏi này bạn được yêu cầu đánh một dấu chéo (X) trên mỗi xác ngôn tương ứng tới khoảng mà bạn đồng ý với mỗi xác ngôn.

Xác ngôn	Hoàn toàn đồng ý	Đồng ý	Không đồng ý	Hoàn toàn không đồng
Thí dụ: Cha tôi thích toán.				
1. Cha tôi nghĩ rằng toán là một trong những môn quan trọng nhất mà tôi đã học.				
2. Cha tôi sẽ không khuyến khích tôi để hoạch định một nghề mà có dùng toán trong đó.				
3. Cha tôi luôn luôn thích thú trong sự tiến bộ về toán của tôi.				
4. Cha tôi nghĩ tôi sẽ cần toán cho những gì tôi muốn làm sau khi tôi học xong trung học.				
5. Cha tôi nghĩ advanced mathematics là phí thời gian cho tôi.				
6. Cha của tôi đã bày tỏ không thích thú rằng tôi có nên học thêm những môn toán hay không.				
7. Cha của tôi đã mạnh mẽ khuyến khích tôi học khá toán.				
8. Cha tôi ghét học toán.				
9. Miễn là tôi đậu, cha tôi không có lo tôi đã học toán như thế nào.				
10. Cha tôi nghĩ rằng tôi có thể giỏi toán.				
11. Cha tôi nghĩ rằng tôi cần biết chỉ một số ít toán thôi.				
12. Cha tôi nghĩ rằng tôi là một loại người có thể khá toán.				

Cha của bạn nói gì về toán mà bạn học ở trường?

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Ông ấy cảm thấy thế nào về sự học toán của bạn ở trường?

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Appendix C

Permission letter and consent form

Dear Parents/Guardians,

I am a post-graduate student at Edith Cowan University, Mt Lawley, currently undertaking my Bachelor of Education (Honours) degree in Mathematics Education.

Throughout Australia and indeed in many parts of the world, there is a growing realisation that girls tend not to achieve their full potential at school, especially with regard to higher level mathematics units. Many girls limit their post-school options by limiting their participation in mathematics in Years 11 & 12.

The purpose of my study is to examine your daughter's attitudes towards mathematics and the reasons why she chose to enrol in certain upper school mathematics units (that is, Geometry & Trigonometry, Maths in Practice, Introductory Calculus, Foundations of Mathematics, Applicable Mathematics, Discrete Mathematics, Calculus and Modelling for Mathematics).

All girls in Years 11 and 12 will be invited to participate in the study. They will be asked to fill in six questionnaires which should take a total of about 30 minutes to complete. Any girl is free to withdraw from the study at any time. I plan to work closely with the mathematics staff to ensure that there is a minimum of disruption to your daughter's learning. The study will take place during August.

All answers will be treated in the strictest confidence, and only a summary of the information gathered (with no names) will be used to write up the report. I will be interviewing about six girls to gather more detailed information on their attitudes towards mathematics and their decisions to enrol in particular units.

If you have any questions concerning the research, please feel free to contact me at home on the above telephone number. Alternatively, you can always contact me via your daughter's teacher. Could you please sign the attached consent form and return it via your daughter's teacher as soon as possible. Thank you.

Yours sincerely,

Consent Form

I have read the information attached regarding the study and any questions have been answered to my satisfaction. I give permission for my daughter

.....(Full name)

.....(Form) .....(Maths Teacher)

to participate in the study, with the understanding that she may withdraw at any time.

Signed: .....

Appendix D

Item response means

Table D1

Item Means for Vietnamese and Non-Vietnamese Girls

Confidence in mathematics

Weight	Statement	Mean	
		Vietnamese	Non-Vietnamese
+	1. I am sure that I can learn mathematics.	3.35	3.31
+	2. I have a lot of self-confidence when it comes to mathematics.	3.00	2.53
–	3. Most subjects I can handle O.K., but I keep doing poorly at mathematics.	3.35	2.51
+	4. Generally, I have felt safe about trying mathematics.	2.92	2.97
+	5. I think I could handle more difficult mathematics.	2.50	2.21
–	6. For some reason, even though I study, mathematics seems unusually hard for me.	2.71	2.54
–	7. I am no good at mathematics.	2.92	3.00
–	8. I do not think I could do advanced mathematics.	2.62	1.97
–	9. I am not the type to do well in mathematics.	2.77	2.67
+	10. I am sure I could do advanced work in mathematics.	2.50	2.17
+	11. I can get good marks in mathematics.	2.81	2.82
–	12. Mathematics has been my worst subject.	3.31	2.46
	N =	39	26

Table D2

Item Means for Vietnamese and Non-Vietnamese Girls

Usefulness of mathematics

Weight	Statement	Mean	
		Vietnamese	Non-Vietnamese
+	1. I will need mathematics for my future work.	3.42	3.04
—	2. Mathematics is of no relevance to my life.	3.65	3.18
+	3. Knowing mathematics will help me get a good job.	3.46	3.03
—	4. Mathematics will not be important to me in my life's work.	3.58	3.15
+	5. I will need to be good at mathematics for my future work.	3.27	2.64
—	6. I expect to have little use for mathematics when I leave high school.	2.42	2.74
—	7. I see mathematics as a subject I will rarely use in my daily life as an adult.	2.77	3.05
+	8. Mathematics is a worthwhile and necessary subject.	3.35	3.26
+	9. I study mathematics because I know how useful it is.	3.42	2.87
—	10. Doing mathematics at school is a waste of time.	3.85	3.15
—	11. In terms of my adult life it is not important for me to do well in mathematics at high school.	3.31	3.26
+	12. I will use mathematics in many ways as an adult.	3.31	2.99
	N =	26	39

Table D3

Item Means for Vietnamese and Non-Vietnamese Girls

Can everyone do mathematics?

Weight	Statement	Mean	
		Vietnamese	Non-Vietnamese
+	1. Females are as good as males in geometry.	2.92	3.44
—	2. Mathematics is for men; arithmetic is for women.	3.19	3.69
+	3. It is hard to believe a female could be a genius in mathematics.	3.23	3.72
—	4. When a women has to solve a mathematical problem, it is feminine to ask a man for help.	3.00	3.72
+	5. Males are naturally better than females in mathematics.	2.85	3.72
—	6. Women certainly are logical enough to do well in mathematics.	3.08	3.56
—	7. I would trust a women just as much as I would trust a man to figure out important calculations.	2.92	3.62
+	8. Girls who enjoy studying mathematics are a bit peculiar.	2.85	3.59
+	9. I would have more faith in the answer for a mathematics problem solved by a man than a women.	3.04	3.64
—	10. Girls can do just as well as boys in mathematics.	3.31	3.82
—	11. Studying mathematics is just as appropriate for women as it is for men.	3.08	3.69
+	12. I would expect a women mathematician to be a masculine type of person.	3.00	3.79
	N =	26	39

Table D4

Item Means for Vietnamese and Non-Vietnamese Girls

My teacher's attitude towards me as a learner of mathematics

Weight	Statement	Mean	
		Vietnamese	Non-Vietnamese
+	1. My teachers have encouraged me to study more mathematics.	3.00	2.99
+	2. My teacher thinks I am the type of person who could do well in mathematics.	2.65	3.08
—	3. When it comes to anything serious, I have felt ignored when talking to mathematics teachers.	2.92	3.03
—	4. I have found it hard to win the respect of mathematics teachers.	3.31	3.00
+	5. My teachers have been interested in my progress in mathematics.	3.15	3.00
—	6. Getting a mathematics teacher to take me seriously has usually been a problem.	2.62	3.09
+	7. Mathematics teachers have made me feel that I have the ability to go further in mathematics.	2.65	2.97
—	8. I have a hard time getting teachers to talk seriously with me about mathematics.	2.85	3.09
—	9. My teachers think advanced mathematics is a waste of time for me.	3.48	2.76
+	10. I would talk to my mathematics teachers about a career which uses mathematics.	2.77	2.51
—	11. My teachers would think I wasn't serious if I told them I was interested in a career in science and mathematics.	3.04	3.05
+	12. My mathematics teachers would encourage me to enrol in as many mathematics subjects that I could.	2.77	2.41
	N =	26	39

Table D5

Item Means for Vietnamese and Non-Vietnamese Girls

My mother's attitude towards me as a learner of mathematics

Weight	Statement	Mean	
		Vietnamese	Non-Vietnamese
+	1 My mother thinks I could be good at mathematics.	3.00	3.01
—	2. My mother thinks advanced mathematics is a waste of time for me.	3.50	2.90
—	3. As long as I have passed, my mother hasn't cared how I have done in mathematics.	3.04	2.79
+	4. My mother has strongly encouraged me to do well in mathematics	3.23	3.08
—	5. My mother has shown no interest in whether or not I take more mathematics subjects.	3.31	3.01
+	6. My mother thinks that mathematics is one of the most important subjects that I have studied.	3.08	2.63
+	7. My mother has always been interested in my progress in mathematics.	3.31	2.99
—	8. My mother wouldn't encourage me to plan a career which involved mathematics.	3.17	2.87
+	9. My mother thinks I am the type of person who could do well in mathematics.	3.08	2.97
+	10. My mother thinks I will need mathematics for what I want to do after I finish high school.	3.29	2.97
—	11. My mother thinks that I need to know just the minimum amount of mathematics.	3.17	2.83
—	12. My mother hates to do mathematics.	3.58	2.60
	$N=$	24	39

Table D6

Item Means for Vietnamese and Non-Vietnamese Girls

My father's attitude towards me as a learner of mathematics

Weight	Statement	Mean	
		Vietnamese	Non-Vietnamese
+	1. My father thinks that mathematics is one of the most important subjects that I have studied.	3.00	3.04
—	2. My father wouldn't encourage me to plan a career which involved mathematics.	3.26	2.84
+	3. My father has always been interested in my progress in mathematics.	3.13	2.93
+	4. My father thinks I will need mathematics for what I want to do after I finish high school.	3.43	3.03
—	5. My father thinks advanced mathematics is a waste of time for me.	3.61	2.78
—	6. My father has shown no interest in whether or not I take more mathematics subjects.	3.13	2.99
+	7. My father has strongly encouraged me to do well in mathematics.	3.09	3.13
—	8. My father hates to do mathematics.	3.52	3.08
—	9. As long as I have passed, my father hasn't cared how I have done in mathematics.	3.33	2.89
+	10. My father thinks I could be good at mathematics.	2.91	3.20
—	11. My father thinks that I need to know just the minimum amount of mathematics.	3.13	3.01
+	12. My father thinks I am the type of person who could do well in mathematics.	3.04	3.16
	$N=$	23	38

Appendix E

Responses to open-ended questions

Table E1

Responses to Open-Ended Questions

How do you feel just before doing a mathematics test or exam?

Non-Vietnamese respondents

NV01. Tense and really stressed. I try to remember everything learnt before that might be on the test/exam.

NV02. Nervous and scared that I won't remember all the set on how to do it and the formulae.

NV03. I feel stupid and not smart enough at first then I feel like I don't care.

NV04. All the information is there but when I sit down and start looking through the test/exam everything seems to disappear. I think it's an act of panic more than anything.

NV05. I feel that I could do it if I studied. If I studied beforehand I feel fairly confident but if I don't study I get a bit worried.

NV06. Very nervous if I know that I can't do it.

NV07. I feel OK if I study. If I don't I feel nervous but I feel I'm still capable.

NV08. Very nervous. Don't want to do it.

NV09. I feel very nervous but even when I study I know that I am going to fail because it goes in one ear and out the other.

NV10. I stress because I know I can not do good so I just give up.

NV11. I feel like the teacher will put in a question that totally tricks us and one that we haven't studied or learnt.

NV12. When I have an exam, I feel nervous and always think I won't do well whereas when I have a test I'm not as nervous.

NV13. I don't usually get nervous before an test but I get extremely frustrated when I can't remember things. This happens most of the time.

Table E1 (continued)

Responses to open-ended questions

How do you feel just before doing a mathematics test or exam?

Non-Vietnamese respondents

NV14. I feel very confident because I know I can handle the exam and the questions that it will ask because I have studied hard and have been doing well in class assignments etc.

NV15. Depending on the subject due to be tested depends on how I feel. If I've crammed on a subject I like and know I feel confident if not I feel under pressure.

NV16. I feel OK if I have studied but I don't get too excited about tests/exams.

NV17. Every time I have a maths test in the past I was OK when going about doing a maths test. I knew I wouldn't do well.

NV18. Before an exam or test on mathematics I feel a bit nervous but not much at all.

NV19. I feel a little bit nervous but usually I don't get too nervous.

NV20. I feel very nervous and wish I wasn't doing it or don't have to do it.

NV21. I usually swear before the exam and try to study with pals before the exam.

NV22. Very nervous and sure I'll do poorly.

NV23. I feel really nervous and scared, even if I have studied and know all of the work. As a result of this I usually do poorly. I also tend to tense up.

NV24. Very nervous.

NV25. If I like the part of the maths course I am doing then I feel OK but if I don't like the section of the course I feel nervous.

NV26. Pretty nervous.

Table E1 (continued)

Responses to open-ended questions

How do you feel just before doing a mathematics test or exam?

Non-Vietnamese respondents

NV27. Most of the time I feel confident I'm going to do well but I usually do OK but not excellent. If I study more I would do heaps better.

NV28. Fairly confident as long as I know what I was doing when doing my class work.

NV29. Nervous but think that I can at leat pass.

NV30. I feel all nervous and really stressed out because I study really hard then end up failing anyway so I get really annoyed.

NV31. If I know the topic really well I will be looking forward to it. If I don't really know it well , I will be very nervous.

NV32. I really enjoy maths tests and exams and feel confident before taking them. If I have studied there is not much you can do wrong.

NV33. Nervous of failing.

NV34. Nervous as I know I will do under 50-60% no matter what.

NV35. If I have studied to my utmost I feel confident but sometimes I feel confident and then the test/exam is different to what I studied and I get a bad mark.

NV36. Before a maths test/exam I get anxious and frustrated because all that I have studied disappears. Once I am in the exam I feel confident.

NV37. I feel majorly stressed. The thought of doing a maths test/exam scares me because I know that I'm going to do badly. Maths has always been my worst subject even in primary school but I never did anything about it.

NV38. I feel so frustrated and confused because I have studied my heart out but I just can't understand the subject. When I get the results back I get really depressed because I tried so hard but I only achieved a C grade.

Table E1 (continued)

Responses to open-ended questions

How do you feel just before doing a mathematics test or exam?

Non-Vietnamese respondents

NV39. I feel that I'm going to forget everything I've studied.

Vietnamese respondents

V01. Before I begin my maths exam I feel very nervous because I have no idea whether the exam will be easy or hard.

V02. In moments of examination I feel nervous because of my fears of failing.

V03. I feel worry when I have exam or test with mathematics. I scare if I may fail.

V04. I only worry about the test or exam because I don't have a good memory therefore sometimes I forget the formula. But it's OK , I do what I can.

V05. I feel worry for my fail test, but I will tried to do it for better.

V06. I feel nervous and scared.

V07. I think I try to get a good mark, nervous.

V08. I feel a bit scared but it's no problem because I love maths.

V09. I felt most confident when I'm doing a mathematics test or exam than other subjects because it always based on the knowledge that I had by using the table book (formula).

V10. Nervous but I enjoyed because I had a good mark.

V11. I feel nervous because usually I do well in class work but not that well in test.

V12. Depends on how hard each topic is. If it is a hard topic I usually feel a little bit nervous but I'm not scared because I would have studied the night before.

Table E1 (continued)

Responses to open-ended questions

How do you feel just before doing a mathematics test or exam?
Vietnamese respondents
V13. I feel like I'm going to fail, sick and not ready for the exam or test.
V14. When I have exam or test about mathematics I have lot of self-confidence that I can pass.
V15. No comment.
V16. Okay!
V17. I feel very confident that I would get a good mark because I know that I have studied hard enough to get it.
V18. I feel confident that O would pass if I tried hard.
V19. Nervous, try to remember the formulas, review all the maths study in the term.
V20. I feel little bit nervous before doing a test or exam.
V21. No comment.
V22. I feel nervous before a math test. I feel angry because some is difficult and I can't understand but some work I know how to do.
V23. Nervous, worry and shaky.
V24. I feel very worried when tests are come up. The result of test or exam. If it poor.
V25. I feel a little bit nervous but I have a lot of self-confidence that I can do it.
V26. I feel very scared and worried because I am scared I will fail in the test or exam.

Table E2

Responses to open-ended questions

If a friend asked you what use would mathematics be after finishing school, what would you tell her?

Non-Vietnamese respondents

NV01. You don't know what job you'll end up applying for and maths is an important prerequisite for nearly all jobs. Even if you don't do a job that involves maths you'll need maths for everyday tasks eg. shopping, cooking etc.

NV02. Yes, it's part of our daily life. Even the simple things like adding up the telephone bill.

NV03. I would tell her that maths is used in everyday life. For example, when you do your shopping you can get the right amount of goods worth the money you have and therefore save yourself any embarrassment if you don't have enough money at the register. It is very useful and there is almost no job that doesn't require a satisfactory level of knowledge of mathematics.

NV04. The use of mathematics is used in everyday life. It is just that we never notice it. Some of the formulas maybe far fetched but all the work in maths is useful.

NV05. You use maths for a lot of little things such as accounting for your expenses (shopping), solving problems etc.

NV06. Nothing, I can't think of anything.

NV07. It will help you get a job. You need and use maths everyday for your life.

NV08. No comment.

NV09. Well, it could help you when you have children, then you could teach them the mathematics that you learned.

NV10. To help your children when I have some.

NV11. It wouldn't really be useful except in everyday life (the basics).

Table E2 (continued)

Responses to open-ended questions

If a friend asked you what use would mathematics be after finishing school, what would you tell her?

Non-Vietnamese respondents

NV12. I would say for around the home use (painting, paving); my work for payrolls, measurements of paper; and I can work out my pay in advance so I won't get ripped off.

NV13. In almost every line of work, maths is used and it is useful in just daily life such as shopping etc.

NV14. Maths is important in getting a further education at university or TAFE etc. It is also important because many employers look for maths in a person's school reports.

NV15. In working either in sport, child care or nursing, measurements and problem solving. It would enable me to work with the people around me.

NV16. For practical problems including money matters etc.

NV17. Help when travelling, dealing with money.

NV18. I would tell her that maths is part of everyday life and it is used everyday one way or another.

NV19. You can use it in everyday life eg. shopping, paying bills and perhaps in your job.

NV20. You use maths all the time everyday. When you add something up or even read a clock.

NV21. You will need maths in the future for your future job or schooling. Also it is just as important as English.

NV22. I would use it in lots of things (budgeting etc).

NV23. I would tell her that in my personal situation I do not believe it to be a great necessity and I don't think most of the things taught can be used in "real life".

Table E2 (continued)

Responses to open-ended questions

If a friend asked you what use would mathematics be after finishing school, what would you tell her?

Non-Vietnamese respondents

NV24. That it is because you will always have problems to solve and number to add.

NV25. You may need good maths scores to get into University. To add up bills and to help find the best interest rates for loans etc. and to use to help your financial affairs.

NV26. Not much use unless you need it for your job or to do more study.

NV27. Well at the moment I'm doing modelling and this unit consists of everyday things eg. tax, water rates, anything you need to know when you move out on your own. You don't have anyone to help you understand these things.

NV28. You need it to get into university and it is good to know as 90% chance you will need it in your job.

NV29. That it is necessary in any field of work, no matter how much you use it or how little you use it.

NV30. I'd tell her I'd need maths to get where I want after I finish high school eg. midwifery.

NV31. You have to know most of the things about maths. If you don't study maths, you wouldn't find a good job or not a job because every job needs calculations.

NV32. Many uses, money management etc. but I'm mainly studying maths for a prerequisite to further education.

NV33. For a job that you wanted and in every type of job needs maths.

NV34. It is included (somehow) in almost every job you are interested in.

Table E2 (continued)

Responses to open-ended questions

If a friend asked you what use would mathematics be after finishing school, what would you tell her?

Non-Vietnamese respondents

NV35. In everyday life, situations may arise where you need to work things out or if someone you know needs help with maths you might be able to help them. It's better to know something (even though you might not use it) than to not know it at all.

NV36. I would tell her that maths will be used at work. For my career and in the house in many ways. In everything you do, maths is needed in someway.

NV37. It would be handy for shopping (make sure you don't get short changed), it may be necessary in a future job for keeping track of your finances and so forth.

NV38. I would tell my friend that mathematics will always be useful for you because sometime or another you will need to find a job and without maths, you can't work anywhere - even basic maths. Maths also teaches you problem solving techniques which you will always use in every day of your life. There are many more reasons, I could go on.

NV39. It helps get a job.

Vietnamese respondents

V01. I will tell my friend that maths will become very useful in my life because it will help me in my future work. Maths will help me shopping.

V02. The need to study mathematics is very important after I graduate because if I need to do calculations in any business I would require a basic understanding of mathematics.

V03. I do need mathematics when finishing school, if I have a job, and go to work at shop or somewhere else. I do need when I do that.

Table E2 (continued)

Responses to open-ended questions

If a friend asked you what use would mathematics be after finishing school, what would you tell her?

Vietnamese respondents

V04. When you get a job you could work out how much you will get paid and set the sum up into a budget list to make sure everything is paid and spent correctly etc. Making sure that employers give the right amount you should be earning etc.

V05. No comment.

V06. I go to TAFE and study accounting or secretary.

V07. I will tell her mathematic use to work eg accounting, bank after finish school.

V08. It will for engineering person, accounting person.

V09. I would tell her that I would use mathematics to get on with my work well because I would like to work in bank officer, so I need a little bit good at maths to be a bank teller.

V10. Teach my kids, or find a job as a cash register.

V11. Yes, maybe.

V12. That she would get a better job and her life would be much easier if she studies maths.

V13. I need it to get into pharmacy, it's good to have some knowledge about maths in everyday life.

V14. No comment.

V15. If a friend asked me what use would mathematics be after finish school, I tell her after finish school if you study good math that you can ??? or teacher math.

V16. Mathematics enables you to be able to have a lot of options open in future careers and studies.

Table E2 (continued)

Responses to open-ended questions

If a friend asked you what use would mathematics be after finishing school, what would you tell her?

Vietnamese respondents

V17. It would help me in everyday life. Nearly everything I do or need to will involve some mathematical calculations and solutions.

V18. That for every job about 98% you would need to know something about maths.

V19. I would tell her if I finish school we have three choice to go is unemployed, go to school, get a job. We can use mathematics to describe which way is good for you.

V20. I will tell her it's very useful to your daily life such as calculate something's that concern to my job.

V21. No comment.

V22. I tell her I'm a good math in class and when I finish school, I will look a good job for office.

V23. I would use mathematics at accounting.

V24. No comment.

V25. I will tell her that mathematics is useful at school. Mathematics helps me to improve better at the other subjects as chemistry, physics etc. I also can use mathematics in my daily life.

V26. No comment.

Table E3

Responses to open-ended questions

What do you think about the question on whether boys or girls are better at mathematics?

Non-Vietnamese respondents

NV01. Everything always comes down to the individual person and individual interests. Boys are more practical and girls are more emotional but that doesn't affect the performance or learning abilities of either sex.

NV02. Girls can be as smart as boys in maths. It depends on how well the person likes maths and the knowledge of it.

NV03. I think they can be equally good at maths. I feel that it is up to a person on how much they will achieve in any subject. It doesn't matter whether you are a boy or girl, you just have to have the determination.

NV04. This comes everywhere saying boys are better than girls. Well, this may be so in the past but it is not now. In the future there will be more girls studying maths as girls are trying to have a career instead of staying home as a mother - like in the past.

NV05. Girls and boys all have the ability to be mathematicians. They should be treated equally. A girl would make just as good a mathematician as a boy.

NV06. I think it doesn't matter what sex you are.

NV07. Boys and girls are all equal in everything that they do.

NV08. No comment.

NV09. Boys and girls are both equal.

NV10. I think it has nothing to do with mathematics. I think that it's stupid and it has nothing to do with maths. This paper is written by a male which explains everything.

NV11. Boys and girls have the same brain and if they both want to learn maths, they both can.

Table E3 (continued)

Responses to open-ended questions

What do you think about the question on whether boys or girls are better at mathematics?

Non-Vietnamese respondents

NV12. I think that bit is sexist. People think like that because most males have as stronger will than females, though I still think both sexes should be treated the same.

NV13. A person's sex has nothing to do with it. It's different for each person how well they cope at maths.

NV14. It doesn't matter what sex you are. It's how much you study and how well you perform in class activities, assignments etc.

NV15. This question is quite biased because depending on one particular person's view toward mathematics depends on whether they are better at it than someone from the opposite sex.

NV16. I think that if every person is given the same amount of encouragement - equally - then both should be the same.

NV17. Gender has nothing to do with achieving well in maths.

NV18. I think that it is sexist because males and females should have equal opportunities. In other words, a woman can do practically anything a man can do.

NV19. I think it is quite sexist that people are suggesting that boys are better than girls at maths and vice versa. I think that everyone has a chance of doing well at maths.

NV20. Everyone is equal and should be treated that way.

NV21. Equal rights.

NV22. It is not true. Girls are just as good.

NV23. Girls can be just as good at maths as boys. I must admit though, I get put off when in a class of boys they "appear" to have more knowledge of the subject.

Table E3 (continued)

Responses to open-ended questions

What do you think about the question on whether boys or girls are better at mathematics?

Non-Vietnamese respondents

NV24. I think that they are equal and have equal ability.

NV25. It is really sexist. How good you are maths depends on how mush you work your brain and how hard you try, not on what your sex is.

NV26. Well usually, I think boys are because the guys need maths for their careers more than girls.

NV27. Very sexist. I believe any one can do anything they want even if your as male or a female. Males just seem to be more interested in it more than females but females who are interested in it will do just as well.

NV28. It doesn't matter whether you are a boy or girl when it comes to maths. How good you are at maths has no relevance to what sex you are.

NV29. That there is no wrong or right answer and that how good you are at maths depends on who you are as a person.

NV30. Well girls get disturbed and so do boys in a mixed classroom. But I'd say most boys concentrate more on maths for some reason or another.

NV31. I think that it does matter whether you are a boy or a girl. You can do the same thing. The thing is the way you study and how serious you work towards the subject.

NV32. Females are just as competent as boys, it's just that females aren't as encouraged as much as males into the field of mathematics.

NV33. There is no better than both. Both boys and girls can be good or bad at maths.

NV34. Stupid. It goes on intelligence, not gender. Your sex has nothing to do with your intelligence level.

Table E3 (continued)

Responses to open-ended questions

What do you think about the question on whether boys or girls are better at mathematics?

Non-Vietnamese respondents

NV35. Its sexist. Guys just assume they are naturally smarter than girls and this puts a lot of girls off the idea of doing maths. This then reinforces the stereotype that guys are smarter. It's only because more of them do it than girls.

NV36. It isn't about being a boy or a girl. It is how much effort and dedication you put into your work. Everyone has the same opportunity to be successful.

NV37. Sometimes it seems that males are given more opportunities than females, but it's hard to tell. I think girls feel stupid compared to males when it comes to maths, well I do.

NV38. I think the only reason why boys are better at maths than girls are is because it has been the proper thing to do. Males have always been in the quantitative while females have stuck to humanities, therefore following tradition. If females were encourages more to get into sciences/maths then more would be better in mathematics.

NV39. Pathetic.

Vietnamese respondents

V01. I believe that both sexes are equal and one could not be distinguished from another.

V02. I believe that both sexes are equal.

V03. I think that it is important because maths is needed for all people boys and girls so we have to trying hard.

V04. No one is perfect whether they're a boy or a girl. You can expect to have some smart guys and some dumb. The same occurs for girls.

V05. No comment.

V06. No comment.

Table E3 (continued)

Responses to open-ended questions

What do you think about the question on whether boys or girls are better at mathematics?

Vietnamese respondents

V07. No idea.

V08. I think that girls can do maths as good as boys but usually boys are a bit better than girls.

V09. I think boys/girls are the same. As good as mathematics. It also depends on how conscious you are?

V10. It really depends if they enjoy maths or not and if they do then they could be good at it. Boys and girls are all the same.

V11. Sexist.

V12. Whether boys or girls are better at maths is of no concern to me. All I know is that if I try hard enough, I will do better.

V13. I think girls are just as good as boys in mathematics if they are prepared to do the work (equal rights).

V14. I think boys and girls are good at math but when they are in Uni I think boys are better than girls because they try very hard.

V15. No comment.

V16. It is simply rubbish, gender won't decide whether a person is good at maths and whether they like maths or not.

V17. I don't believe (boys and girls) in who is better. If you study hard and understand while enjoying maths anyone can be good at mathematics.

V18. I think it's stupid because no one is better than anyone and if you try hard you can do just as well.

V19. I think the boys are very intelligent about mathematics but they very lazy when solve the mathematics problems. And girls are not intelligent like boys, but they work hard to solve the problem in mathematics.

Table E3 (continued)

Responses to open-ended questions

What do you think about the question on whether boys or girls are better at mathematics?
Vietnamese respondents
V20. I think maybe boys are better than girls but they are too lazy to study.
V21. No comment.
V22. I think about boys and girls is different because the boy usually lazy but girls not very the same girl.
V23. Mostly boys are better at mathematics than girls.
V24. No comment.
V25. I think that boys can do better in mathematics as an adult at the ages 17, 18, 19 . . because at these ages girls are usually have distributed by others problems. However, girls also can do just as well as boys in mathematics.
V26. No comment.

Table E4

Responses to open-ended questions

How would your teacher describe you as a learner of mathematics?

Non-Vietnamese

NV01. Slack, but not incapable.

NV02. Yes, maybe.

NV03. I think he would describe me as having potential, but I am not determined to take the subject further.

NV04. It takes a long time to learn but the ability is there - that's how the teacher would describe it. He would probably also say that I have the ability and sometimes doesn't use it.

NV05. Capable but needs to do more study.

NV06. An average student.

NV07. Capable of doing work.

NV08. No comment.

NV09. A slow learner!

NV10. Mr P was good and made me like maths for one term.

NV11. I think he thinks I'm a quick learner.

NV12. I don't know.

NV13. It's hard to know what your teacher thinks but she probably thinks I could do better.

NV14. I think she would think that I am a quite capable student and that mathematics is pretty easy for me. She encourages me to attempt harder problems at home that will help me in the learning of the subject.

NV15. Someone who tries very hard but can get better results than I'm getting if I commit myself a bit more.

Table E4 (Continued)

Responses to open-ended questions

How would your teacher describe you as a learner of mathematics?

Non-Vietnamese

NV16. Does quite well in most areas but finds it hard to get over 80% in any tests.

NV17. Exact words "Capable but doesn't try".

NV18. My teacher would describe me as a conscientious, good learner.

NV19. No comment.

NV20. Alright, I guess.

NV21. Last years' teacher was no help, so I would not know.

NV22. I don't know.

NV23. That I have the ability and capability although lack a bit of self-confidence.

NV24. If I apply myself, I get results.

NV25. Okay, but too lazy to do really well.

NV26. Alright but doesn't apply herself.

NV27. I'm just average but my abilities are higher and past teacher knows this and helped me push myself further. But most of the time maths came last for me so I stay average.

NV28. Alright at maths, quite capable of doing it.

NV29. I have no idea.

NV30. She'd probably describe me as a learner of mathematics but not that good.

NV31. Maybe hardworking.

Table E4 (continued)

Responses to open-ended questions

How would your teacher describe you as a learner of mathematics?

Non-Vietnamese

NV32. I hope they wouldn't think I was too bad at learning mathematics.

NV33. I try hard and I can do the best of my ability.

NV34. Could do better if she tried (that's what they all think anyway).

NV35. I don't know. Ask her! It takes a while for me to absorb things in but once they're in, they're in there for good.

NV36. My teachers feel that I am capable of advancing myself to do a higher level of maths.

NV37. Average. Unfortunately, the females in my class are outnumbered 6:10 (usually more) and the guys make a big "thing" about stuff we do. For that we hardly learn anything, so my mathematics ability hasn't increased and I'm sure my teacher would agree.

NV38. She has the ability to do well at maths if only she practiced just a bit more. She needs to apply herself more to achieve a higher and more deserved grade.

NV39. I don't know.

Vietnamese respondents

V01. My teacher believes that I am capable to achieve well in maths and he encourages me to do well.

V02. My teacher said that I am an average student.

V03. He never say that but I think I am not doing really good.

V04. I don't know because I'm treated equally as others in the room.

V05. No comment.

Table E4 (continued)

Responses to open-ended questions

How would your teacher describe you as a learner of mathematics?

Vietnamese respondents

V06. I don't know.

V07. I don't know.

V08. No comment.

V09. Study hard, always completed the work.

V10. OK at maths but really hate my maths teacher and he doesn't talk to me about my career or anything.

V11. Don't know.

V12. I don't know but I do try hard.

V13. That I'm able to cope with the more difficult mathematics ie. G & T, calculus.

V14. No comment.

V15. No comment.

V16. I don't have a clue. Never really talked to the teacher I suppose.

V17. Enthusiastic, hard working and considerate student in class.

V18. They would describe me as a hardworking student and is keen to learn new things to do with maths.

V19. Normal student, not very intelligent but work hard.

V20. He said that I'm doing excellent, hard working.

V21. No comment.

V22. My teacher describe a learner of math is well, but sometime I can't understand and don't know what a teacher said, because I don't English is very well.

Table E4 (continued)

Responses to open-ended questions

How would your teacher describe you as a learner of mathematics?

Vietnamese respondents

V23. Interesting in mathematics, enjoyable person.

V24. No comment.

V25. The statement below I answered my teacher's attitude towards me (my maths teacher in Vietnam) only because my maths teacher in Australia is not say about how my mathematics yet. My teacher think that I am good at mathematics. My teacher usually want to teach me more mathematics. My teacher thinks I may not learn maths as well as the clever people but I still good at maths because I always try hard.

V26. No comment.

Table E5

Responses to Open-Ended Questions

a) What does your mother say about the mathematics that you do at school? b) How does she feel about your doing mathematics at school?

Non-Vietnamese respondents

NV01. She thinks I could do better if I tried (more advanced class) but it's a good range of skills.
She encourages me to do more study.

NV02. Nothing as long as I get good marks.
Fine.

NV03. She doesn't really get that much involved in my studies but she cares about the grades I get and pushes me harder to get better grades. She believes that mathematics is necessary for the future. She wants me to learn as much as I can.
She pushes me to do well and is upset if I do badly but she believes that I will pass all my subjects and maths very well, if not this year then next year.

NV04. She thinks that sometimes I push myself too hard and would be happy if I did a lower maths unit. As long as I pass.
She encourages me as much as she can and thinks that it's good as most careers these days have some sort of maths in it.

NV05. She doesn't really say anything because she studied in Burma and wasn't able to go on to high school.
She says if I want to do it then I should go for it.

NV06. It's good.
She doesn't care.

NV07. She would like me to do maths in any way I can.
She thinks that it is great.

NV08. No comment.
No comment.

NV09. No comment.
No comment.

Table E5 (continued)

Responses to Open-Ended Questions

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a) What does your mother say about the mathematics that you do at school?
b) How does she feel about your doing mathematics at school?

Non-Vietnamese respondents

NV10. Do good and I'll be happy.
She just wants me to do good in all my subjects and she just wants me to do what ever I am good at.

NV11. She said it suits me.
Fine, I need it for my report.

NV12. It's easy and they didn't use calculators when they were young so why should we. She thinks we get it easy.
She thinks its very worthwhile.

NV13. She doesn't really understand about the different levels of mathematics.
She's just happy as long as I do any sort of maths.

NV14. She thinks it is important to do mathematics at school and achieve good results in it . Also, she says mathematics is very important if you want to go to university or further study. Basically because it is a TEE subject.
She feels strongly about me doing maths at school. She thinks I am quite capable at doing maths so why should I waste it by not doing maths at school.

NV15. Because she's from New Zealand, she says that it has developed quite a lot and that she was unable to do highest level at her school so she doesn't have a clue as much as she wants to.
She's quite pleased and says that if I don't want to do it I don't have to. She advises me to do in order to get a good job in later life.

NV16. She is quite interested in it.
She encourages me.

NV17. Doesn't because I don't do maths.
Would like if I did. But it's not what I want so she leaves it at that.

NV18. That it's quite educational and good for me.
She thinks that it's good to do maths.

Table E5 (continued)

Responses to Open-Ended Questions

a) What does your mother say about the mathematics that you do at school? b) How does she feel about your doing mathematics at school?

Non-Vietnamese respondents

NV19. She says do your best at any subject no matter what the level of difficulty it is.
She thinks it is a necessary subject to do.

NV20. She says maths in practice is good for everyday life and just try. That's all you can do.
She doesn't care as long as I am doing a bit of maths.

NV21. That I could do better and be the best student.
At the moment I'm not doing any mathematics subject so she is disappointed.

NV22. She says it will be useful.
She thinks it's good for me but I don't try hard enough.

NV23. She is pleased that I took a TEE maths subject that I am capable of and that I have the ability to do well in.
She says it's my decision and would support me either way but she does think it's an important subject.

NV24. That I'm doing the right level for me.
She thinks it's important.

NV25. My mum is Japanese and she thinks it's a waste of time.
She doesn't feel that it is useful because she doesn't like mathematics.

NV26. I should do a harder unit.
Good.

NV27. When I was in primary school, I was one of the best but now I'm average. She knows I can do better and she feels disappointed in me.
She feels maths is an important subject just like English.

NV28. She says it's good and always asks me how I do in assignments, exams etc.

Table E5 (continued)

Responses to Open-Ended Questions

a) What does your mother say about the mathematics that you do at school? b) How does she feel about your doing mathematics at school?

Non-Vietnamese respondents

NV28. She is pleased with it and glad that I'm doing maths.

NV29. Not much, just do well.
That I should do a TEE level of maths and do well.

NV30. All she says is "Let's wait and see what your grade is" and when I've told her that I've done well all she'll say is "You can do better".
I don't think she really cares but she told me to do maths because it helps me more in the future.

NV31. She says it is good but I should have been in a higher class.
Great.

NV32. She thinks the mathematics I do are well beyond her but she has always encouraged me.
Great. She knows I am well suited to mathematics as she used to teach me maths before I started school.

NV33. She doesn't say anything about maths.
She doesn't talk to me about it at all.

NV34. Not much. When I was younger she always wanted me to pass.
Nothing more, nothing less.
She goes along with anything I choose to study. Anyway, it's entirely up to me. She can only give an opinion.

NV35. Nothing, just that I should try my hardest.
It's all education.

NV36. She understands why I chose to do the level of maths that I am doing.
However, she feels that I should choose a maths course that is more challenging.

Table E5 (continued)

Responses to Open-Ended Questions

a) What does your mother say about the mathematics that you do at school?
b) How does she feel about your doing mathematics at school?

Non-Vietnamese respondents

NV37. She says that even if I could, it's not worth me doing an advanced maths eg a TEE subject, because I don't want to go to University.
She doesn't say much but she worries if I come home and say I did an early childhood assessment in maths because the guys made the lesson impossible to do.

NV38. My mother says that the maths that I do at school, even though I might not think much of it now, it will benefit me in the end for work, study, everyday life or which ever I choose.
She's happy that I'm doing a TEE maths subject because it will help me get into what I want to do - which is medical science.

NV39. Nothing.
I don't know.

Vietnamese respondents

V01. My mother said that maths is suitable for me to study. She said that it would be beneficial to my future.
She is very happy when she knows that I can understand maths.

V02. Sorry, I cannot answer this question because my mother has passed away.

V03. She said you need to try hard when you studies math or any subject. She alway said me so.

V04. As long as I do well (in whatever I'm doing), she will be happy to hear.
Happy. At least she knows I know how to work out simple daily life sums like shopping list, budgets etc.

V05. No comment.

V06. Low math.

Table E5 (continued)

Responses to Open-Ended Questions

a) What does your mother say about the mathematics that you do at school? b) How does she feel about your doing mathematics at school?

Vietnamese respondents

V07. She will ask about what graduated I get.
If I done well she feel happy.

V08. She said that she likes me to learn Geometry and Trigonometry too.
She hadn't been pleased with my B grades at maths.

V09. She always said "try your best" or Study hard".
It's good.

V10. She is a Vietnamese person and she doesn't know about our grades but she would like us to do well.
Good.

V11. Nothing.
Don't know.

V12. She has no opinion.
As long as I do well, she doesn't care.

V13. Nothing.
OK.

V14. Now I studies Mathematics in Practice but my mum think I good at Foundations of Mathematics.
Mum feel very good about how I'm doing math at school.

V15. No comment.

V16. Looks very difficult.
She tries to encourage more mathematics study at home.

V17. Keep up with the good grades.
Very pleased.

V18. She thinks it is the right course for me to do and achieve a good grade.
She thinks it's important because it will gain me a good career.

Table E5 (continued)

Responses to Open-Ended Questions

a) What does your mother say about the mathematics that you do at school? b) How does she feel about your doing mathematics at school?

Vietnamese respondents

V19. No comment.

V20. Good. You must work hard to do your best.
Happy and pleasant.

V21. No comment.

V22. My mother say about the math is good, because she think if I doing a good math, I easy looking a good job.
She feel very happy and love her daughter.

V23. My mother say I am alright.
She feel very pleasure.

V24. No comment.

V25. My mother said that the mathematics units I've learned at school all interesting. It is very useful to me in the future.
She feel my mathematics has a bit going down now because I have concentrate to study other subjects.

V26. My mum say math is good for you in the future.
It is good.

Table E6

Responses to Open-Ended Questions

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a) What does your father say about the mathematics that you do at school?
b) How does he feel about your doing mathematics at school?

Non-Vietnamese respondents

NV01. Don't really discuss it with him but I don't think he thinks I'm good enough to make anything of myself.
He knows it's important subject but I doubt that he has a lot of faith in me.

NV02. OK as long as I get good results.
Fine.

NV03. He thinks mathematics is very important and that I should try and learn as many subjects of mathematics as I can. He believes the better and more you do in maths the bigger the choice of getting a good job.
He is upset at the moment because he feels I am not using my full potential.

NV04. He doesn't say much really. He's just glad that I'm doing a maths course and I'm doing well.
Well as long as I'm doing some sort of maths course. I suppose he thinks it's OK. Both parents worry is whether I will do well or not.

NV05. He says it's fairly important and very interesting.
He thinks I should try my best.

NV06. He doesn't say anything.
He doesn't care.

NV07. My father has shown a lot of interest in the maths that I do.
Same about feelings.

NV08. No comment.
No comment.

NV09. No comment.
No comment.

NV10. Same as mum. Do good and I'll be happy.
Same as mum. He just wants me to do good in all my subjects and he just wants me to do what ever I'm good at.

Table E6 (continued)

Responses to Open-Ended Questions

a) What does your father say about the mathematics that you do at school? b) How does he feel about your doing mathematics at school?

Non-Vietnamese respondents

NV11. Nothing.
Fine. He's really good at it so he agrees that I should do it too.

NV12. It is easy but why should we use calculators when they didn't.
Very important.

NV13. He's just glad I'm doing maths.
He is happy about it because he believes it's a very important subject.

NV14. He thinks much the same as my mum. That it is very important to do maths for your future career.
He thinks it's very good because he knows I have the potential to do very well in maths.

NV15. He says that it is very different and more advanced than what he did and that he doesn't really understand what it is all about.
He isn't forcing me to take it but is leaving it up to me to decide but he also feels that it is important for me to take it in order to get a good job.

NV16. He says it looks quite hard.
He encourages me and monitors my progress. He is happy when I do well.

NV17. He doesn't say anything because I don't o maths. My father backs me up with what I choose.
Nothing. It's very good.
He thinks it's good that I'm doing maths at school.

NV18. He doesn't say a lot. He only says try your best or do the best you can.
He thinks it is a necessary subject.

NV19. It is helpful when you work.
He is happy I do maths.

NV20. Same as mum. I could do better and be the best student.
Same as mum. He is disappointed that I'm not doing any maths at the moment.

Table E6 (continued)

Responses to Open-Ended Questions

a) What does your father say about the mathematics that you do at school? b) How does he feel about your doing mathematics at school?

Non-Vietnamese respondents

NV21. Not applicable.

NV22. He thinks I have chosen a suitable maths course for me.
He is happy that I chose it. He thinks maths is important.

NV23. Doesn't comment.
Doesn't comment.

NV24. My father is Dutch and he thinks I should have dome higher maths subjects but he is happy I do maths.
He is happy because he thinks it is worthwhile and useful for future life and job prospects.

NV25. It's too easy.
It's not relevant to life.

NV26. My dad enjoys a challenge and maths gives him this. In year 11 we were doing the maths (dad went to TAFE) and we helped each other out. Then I was doing Foundations.
He thinks I should study more and not be so lazy.
NV27.
He says it's good and I should learn it well, as it is a very important subject.
Very pleased, and hopes I do well in it.

NV28. That I should do it and do well in it.
Same answer as my mother's. That I should do a TEE level maths and do well.

NV29. Nothing.
He doesn't really care.

NV30. Same comment as my mother. He says it is good but I should have been in a higher class.
Good, as long as I am getting A's for it.

Table E6 (continued)

Responses to Open-Ended Questions

a) What does your father say about the mathematics that you do at school? b) How does he feel about your doing mathematics at school?

Non-Vietnamese respondents

NV31. He thinks that it is beyond him but it's not a waste of time.
He's fine with it. I think he would be happy whatever subject I do and doesn't encourage me more in maths than any other subject.

NV32. My dad doesn't talk much but he has helped me.
He told me it's improved a lot through the years.

NV33. He wants me to pass and can't understand when I don't because he is very good at maths.
Fine. He would be mad if I didn't do any maths subjects. He's happy as long as I am doing a maths subject.

NV34. Are you passing?
It's all education.

NV35. He supports me in whatever I choose if it is going to benefit me.
No comment.

NV36. He doesn't take much interest, but says when he was young he would do trigonometry, geometry, calculus and so forth and asks why I don't.
He reckons I should do what I can handle but he's glad I'm doing some sort of mathematic program.

NV37. He says exactly what my mum says. My father says that the maths that I do at school, even though I might not think much of it now, it will benefit me in the end for work, study, everyday life or which ever I choose.

NV38. The same as mum. He's happy that I'm doing a TEE maths subject because it will help me get into what I want to do - which is medical science.

NV39. Nothing.
I don't know.

Table E6 (continued)

Responses to Open-Ended Questions

a) What does your father say about the mathematics that you do at school? b) How does he feel about your doing mathematics at school?

Vietnamese respondents

V01. My father said that maths is most appropriate to my future.
My father feels OK.

V02. My father encourages me to study maths since he stresses that it would benefit my future.
My father worries that I will not pass my maths unit.

V03. He said you must studies hard for maths that is good for your future.
He worry about that very much.

V04. Same as my mother - As long as I do well (in whatever I'm doing), he will be happy to hear.
Same as my mother - Happy. At least he knows I know how to work out simple daily life sums like shopping list, budgets etc.

V05. No comment.

V06. Low math.

V07. As above. *(Reflecting responses to questionnaire - scored 37.)*
As above. *(Reflecting responses to questionnaire.)*

V08. He said that you should do at least on math at school, try hard.
He feel OK at my last grade.

V09. My father said "Try to do your maths at school well because you need it for future (career)."
It's very good.

V10. Same as other side. He is a Vietnamese person and he doesn't know about our grades but he would like us to do well.
Nothing to say.

V11. No comment.

V12. Same as mother. He has no opinion.
Same as mother. As long as I do well, she doesn't care.

Table E6 (continued)

Responses to Open-Ended Questions

a) What does your father say about the mathematics that you do at school? b) How does he feel about your doing mathematics at school?

Vietnamese respondents

V13. Nothing.
OK.

V14. No comment.
No comment.

V15. Nothing.
As long as you enjoy maths and achieve to your potential he is happy.

V16. "Study hard."
Very pleased.

V17. He thinks it is the right course for me to do and achieve a good grade.

V18. He thinks its important because it will gain me a good career.

V19. My father say the mathematics I do at school is hard and he encouraged me to do well in mathematics.
No comment.

V20. Good. Try your best.
Pleasant about what I am achieved now.

V21. No comment.

V22. My father say the math very important.
He feel happy and like a math.

V23. He say I doing okay.
A bit disappointed when I getting bad marks.

V24. No comment.

V25. My father was passed away 6 years ago.

V26. Maths is important, keep going up.
No comment.