ASTON UNIVERSITY

SEX DIFFERENCES IN ATTITUDE TOWARDS MATHEMATICS - AN INVESTIGATION IN IRAQI SECONDARY SCHOOLS

AFRA TARIK JASSIM AL-SAUD

MASTER OF PHILOSOPHY

OCTOBER 1985

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SUMMARY

The aim of this study was to investigate sex differences in attitudes towards mathematics among secondary school pupils in Iraq. Three underlying influences were identified as having a major impact on shaping pupils' attitudes towards mathematics. These were Teacher, Parent and Curriculum influences. Four questionnaires were administered to a sample of 436 pupils (227 girls and 209 boys) in the third year of the intermediate level (14-15 years of age) distributed among six secondary schools in Baghdad and representing differing social classes and economic backgrounds. The first questionnaire was to ascertain whether there were any sex differences in the attitudes of pupils towards mathematics; the second was to measure the influence of teachers; the third was to measure the influence of parents; and the fourth was to measure the influence of the curriculum (all as perceived by the pupils themselves). A fifth questionnaire was administered to a small sample of Iraqi mathematics teachers to ascertain their attitudes and expectations.

The analysis of the data revealed that there were significant differences between the sexes in their attitudes towards mathematics with boys having the more positive attitudes. It was also found that factors influencing attitudes generally affected boys more positively than girls; and that the social class of the school, and the occupation level and educational attainment of the parents all exhibited various significant influences on the attitudes of pupils.

Key Words : Sex Differences
Mathematics Education
Secondary Schools
Iraq.

TO MY HUSBAND

AND

MY SONS

ACKNOWLEDGEMENTS

I am indebted to many people for their co-operation, advice and encouragement.

In particular, I would like to thank my Supervisor, Doctor Peter Coxhead, for his interest, encouragement, practical help and patience without which this effort would not have been possible.

Thanks are also due to the Iraqi Ministry of Education for granting me the study leave to carry out this research, and for their support and backing during the field investigation.

I am also indebted to all the officials in the Baghdad City Education Directorates for their help and co-operation in arranging the field testing and to the Headmasters/Headmistresses and Teachers of the schools where testing took place.

My thanks to Mrs W Betts for her speed precision and accuracy in typing this thesis.

Finally, a special thank you must be recorded to my husband for his support, encouragement and patience.

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CHAPTER 1

INTRODUCTION

Developing countries, in their attempts to achieve modernity and promote industrialization, have placed a heavy emphasis on science and mathematics based education. This emphasis, they hope, will instill in their young people favourable attitudes toward the use of science and mathematics. This fact is particularly true in the teaching of mathematics which is regarded as the foundation for general scientific advancement. Frequently, in functioning under severe economic and personal constraints, where educational equity within a nation is improbable, decisions must be made as to the allocation of educational resources in order to ensure an efficient nurturing of human scientific potential. In such situations, a paramount decision is which particular subpopulations would supply most attractive returns for the educational investment. In many traditional societies of the third world, this subpopulation is assumed to be urban males.

Iraq is an oil producing developing country. Since 1973 (the increase in oil prices) the rate of growth and development have risen sharply. Great emphasis has been placed on the development of the educational system to meet the demands of future development. Scientific and technological education are given the highest priorities in education planning and investment. As outlined in Chapter 2, the pursuance of scientific and technological careers is highly correlated with favourable attitudes towards, and high achievement in, mathematics. Therefore, the investigation of factors that influence the attitude of pupils towards mathematics is of great importance to Iraq.

Mathematics is, in part, a process which forms an important and unique part of knowledge as a whole. It is the language of science. Science, both pure and applied, could not have developed without it. Mathematics also happens to be an important part of the school curriculum from the primary to the secondary stage, whereby the syllabi are sequential as the secondary school builds upon the primary and extends into college. Furthermore, mathematics is widely accepted, as it will be made clear in Chapter 2, by pupils as the one of worst taught subjects and it appears to have

some "peculiar" properties as it seems at times to arouse extreme feelings of dislike and fear.

Currently there is a world wide movement towards the reconstruction of mathematical education. Experimental syllabi with modern materials and methods have been developed. The demand for this being based upon the need for up to date content and the necessity for more education in mathematics for the space age. Iraq, for example, is devoting considerable effort to the modernisation of its mathematics curricula and methods of teaching in general secondary and intermediate schools.

In assessing the mathematics performance and potential of students, attitudes towards mathematics and mathematical learning are frequently cited as factors contributing to success. Several studies have shown that positive attitudes are conducive to good performance (Hungerman, 1967). However, an individual's attitude towards mathematics can be influenced by many factors (Aiken, 1976; Head, 1981). Three such influences which have been the focus of investigation are the teacher, parents and the mathematics curriculum.

With regard to sex differences in attitudes towards mathematics, there are differences in research results. While some workers have indicated that there were no difference between boys' and girls' attitudes towards mathematics, others have indicated that there are significant differences. The differences between boys and girls in attitudes towards mathematics and their causes are of interest. Do, for example, boys have more mathematical competence than girls? This is a difficult question yet at the same time it is an important one since school syllabi in Iraq are the same for both boys and girls.

In fact the literature in the field of sex differences in attitudes toward mathematics and the nature of the factors which influence the attitudes of the sexes towards mathematics is mostly British and American. However, in Iraq, little research has been undertaken to study the sex differences in attitudes towards mathematics, the factors which influence boys' and girls' attitudes towards mathematics and the

influence of mathematics teachers, parents and the mathematics curriculum on sex differences in attitudes towards mathematics.

Outline of the Thesis

The present study is designed with the following aims in view:-

1. To identify the preferences and attitudes of the third year of Iraqi intermediate schools towards mathematics as a subject of study.
2. To investigate the influence of teachers, parents, and mathematics curriculum, on pupils' attitudes towards mathematics.

To achieve these aims, the study will include:-

- A review of the relevant literature relating to achievement in mathematics and attitudes toward mathematics, and the relevant factors influencing them - this is the subject of Chapter 2.
- A brief description of the Iraqi educational system - this is the subject of Chapter 3.
- Measurement of attitudes towards mathematics and the influences of teacher, parents and curriculum. Since no measures meeting the requirements of the study were readily available, instruments were constructed to measure these concepts. The design and development of these instruments are tackled in Chapter 4, and their validation in Chapter 5.
- The results obtained in this investigation, their analysis and discussion are the subject of Chapter 6.
- The thesis concludes with a brief outline of the study's conclusions in Chapter 7.

CHAPTER 2

SEX DIFFERENCES IN MATHEMATICS - AN OVERVIEW

2.1 The Nature of Sex Differences in Mathematics

The main questions here are: Whether there are any sex differences in achievement and attitudes towards mathematics, and if so, what are the conclusions of published studies, reviews and reports.

There have been many studies of sex differences in achievement and attitudes related to mathematics. Most of these studies found that girls are less favourable towards and of lower achievement in mathematics, than boys. Very few of them indicated that there are no sex differences in mathematics.

The literature dealing with whether there are any sex differences in mathematics can be classified into:-

2.1.1 - Sex differences in attitude towards mathematics

2.1.2 - Sex differences in mathematical ability

2.1.3 - Sex differences in participation and career orientation

These will be reviewed in turn.

2.1.1 Sex Differences in Attitude Towards Mathematics

A substantial number of studies have been done on the subject of attitudes towards mathematics. Pritchard (1935) in a study of the relative popularity of secondary school subjects, at various ages in British Schools, found that mathematics as a subject of study was not very popular. He further reported that it seems likely that the mathematical subjects are unpopular partly because of their lack of objective interest, and partly because the adolescent mind is not fully developed to the stage when it is easy to think in symbols.

Shakespeare (1936) reported on his enquiry into the relative popularity of school subjects in British elementary schools, where he dealt with very large sample (more than 9,000 boys and girls between the ages of 10 and 13); his results were not as negative as those of Pritchard as far as interest in mathematics is concerned. His results are shown in table 2.1.

Table 2.1. Position of Arithmetic in List of Preferred Subjects

Sex	Age - 10	Age - 11	Age - 12	Age - 13
Boys	7/15	3/15	2/15	5/15
Girls	9/17	6/17	5/17	10/17

He concluded that, in the case of both boys and girls, subjects which allowed bodily activity were more popular, and that the more abstract and routine subjects tended to be less popular. The reasons given to explain this popularity support the suggestion that a pupil is more interested in doing than thinking.

Similar findings appear in recent work. Selkirk (1972) stated that "an active dislike" was recorded by a markedly and consistently higher proportion of British "A" level pupils towards mathematics than any other subject. However, Gopal Rao (1973) found differently; he made an attempt to ascertain the attitudes towards mathematics of children attending junior and secondary school in a new town not far from London. He found that in the case of junior school children (age 10+) both boys and girls considered mathematics to be an important and useful subject. Of interest too, is his conclusion that mathematics is one of the more popular or preferred subjects among this group. These findings were supported by Badary (1978); he made an attempt to ascertain the attitude towards mathematics of pupils in the first year of secondary school (13 years) in Egypt. He concluded that:-

> "Mathematics as a subject of study in the first year of general secondary school is one of the more favoured subjects".

Concerning the difficulty of mathematics, research findings were in agreement that it was percieved to be one of the difficult subjects. Keys and Ormerod (1976) sampled 348 GCE stream fourteen-year old pupils (194 girls and 154 boys) in nine Grammer and two Comprehensive schools in South East England, the Midlands and the North, and reported that mathematics was considered to be one of the most

difficult subjects. In an "international study of achievement in mathematics" (Husen 1967), 13 and 17 year olds of 12 countries were asked to complete five attitude scales: attitude towards mathematics as a process; attitude to the difficulties of learning mathematics; and attitude to the place of mathematics in society. Relevant results of this investigation were:-

1 - A tendency for students, in countries in which the "New Mathematics" was taught, to see mathematics as more open and challenging.

2 - The upper-level (older) students tended to perceive mathematics as more difficult and demanding.

3 - Mathematics was viewed as less socially vital or valuable by students with the longest exposure to it and by students in countries where English is spoken.

Aiken and Dreger (1961) studied the effect of attitudes on performance in mathematics, by analysing the scores on the mathematics pretest, administered during orientation week, of entering freshmen at a Southeastern College in US, and found that:-

1 - There is a slight suggestion that females with good 'adjustment to reality' have more positive feeling towards mathematics than those with poor adjustment. For males, leadership qualities and positive mathematics attitudes may be related.

2 - Mathematics attitudes were apparently related to remembered impressions of teacher, the female more clearly so than the male attitudes.

3 - Mathematics attitudes were positively correlated with numerical ability.

Aiken (1972) studied attitudes toward mathematics in three age groups and two sex groups, in US. The three age groups of students represented three age educational levels 5-7 years apart on the average. He reported that:-

1 - There was a general variable of attitude toward mathematics that included attitudes toward routine computations, terms and symbols and word problems.

2 - Attitude toward mathematics was directly related to interest in problem-solving tasks in general, but inversely related to interest in language, art, social studies, and other "verbal" pursuits. Students with more positive attitudes towards mathematics tended to like detailed work and see themselves more persevering or self-confident.

To summarize, the studies reported here clearly indicate that:-

1 - Mathematics as a subject of study appeared to be one of the more unpopular subjects among secondary school pupils.

2 - Attitude towards mathematics was found to be positively correlated with interest, curriculum and numerical ability.

Less agreement exists with regard to sex differences in attitudes towards mathematics. Pritchard (1935) found that among British Secondary School pupils, mathematics or a particular branch of it such as arithmetic, appeared much lower in the list of subjects arranged in order of preference in the case of girls than in the case of boys. Similar findings were found by Shakespeare (1936) among British elementary school pupils. However, Harvey (1957) found differently, in that there were no differences between boys' and girls' attitudes towards mathematics and their attitudes were unaffected by the sex of their teacher.

In "the international study of achievement in mathematics" (Husén, 1967), boys indicated a greater interest in mathematics than girls; sex differences in interest in mathematics being slightly larger in co-educational schools than in single-sex schools. Selkirk (1972) differed; he reported that girls had more favourable attitudes to "O" and "A" levels mathematics courses than boys.

Support for the findings of Pritchard, Shakespeare, and Husén was offered by Gopal Rao (1973); his results obtained from the administration of several questionnaires, pointed to significant differences between boys and girls in attitudes

towards mathematics; the boys always showing more favourable attitudes. He stated that these differences between boys and girls could be related to, and explained in terms of, three influences:-

1 - The attitudes towards the subject of close friends of pupils.

2 - The attitudes towards the subject of the parents.

3 - A pupil's general attitude towards the school.

Ormerod (1975) investigated the subject preferences and subject choices of 1,204 pupils (518 boys, 686 girls) drawn from 10 single sex grammar schools, five co-educational grammar schools and four comprehensive schools in four major regions in the UK: the North, the industrial Midlands the arc of mainly agricultural counties from the South Coast to East Anglia, and lastly from the South-East, including Greater London. The results indicated that differences between the sexes in subject popularity were such that boys preferred mathematics, physical sciences, chemistry and physics, and girls preferred art, english, french, a second modern language and latin.

Aiken (1972), reported that the differences between the means of the mathematics attitudes scores of males and females, was non-significant in both eight-grade and graduate US student groups. However, the mean attitude score of the college freshmen males was significantly greater than that of the college freshmen females.

Frank et al. (1983) concluded from a substantial literature review that:-

> "It is generally held that females exhibit less positive attitudes towards mathematics than males do".

They used a survey which was devised by randomly combining items from two distinct scales of the international study on mathematics achievement: attitude toward the place of mathematics in society - Mathsoc; and attitudes toward school and school learning - Schola. This scale was administered to a sample consisting of (1,000) 13-year olds, 500 males and 500 females, in Malaysia. A similar procedure was carried out in Indonesia with sampling restricted to Java. They found that males express more positive attitudes towards mathematics than females do in Indonesian Schools, while they found

differently in the case of the Malaysian schools, where they stated that:-

> "There is no significant differences in attitudes towards mathematics between Malaysian males and females".

To summarize, most of the findings discussed so far merely suggest that when differences between the sexes do exist with respect to attitudes towards mathematics, boys have more favourable attitudes than girls. However, these differences are only found for some age ranges in some of the countries studied.

2.1.2 Sex Differences in Mathematical Ability

The differences in mathematical ability between the sexes have been the subject of much educational research. Questions which have been tackled by the many studies reviewed here include: are there any differences, and if so, which sex has the superior ability; and, when do these differences become apparent.

Maccoby (1966) in a review including both the psychological and educational literature published before 1965, concluded that:-

1 - Girls learn to count at an earlier age than boys.

2 - There are no consistent differences in computation throughout the grades.

3 - During grade - school years some studies show boys beginning to forge ahead on tests of arithmetical reasoning although a number of studies reveal no difference on this dimension.

4 - Boys excel at arithmetic reasoning in high school.

He also reported that girls usually do better in verbal and linguistic studies than boys, and that boys generally show stronger numerical and spatial aptitudes and perform better in tests of mathematical reasoning. Fennema (1974) in a review of studies about achievement in mathematics, concluded that:-

> "Some authors believe the sex differences in mathematical achievement has not always appeared, most authors feel that when it does appear, it is in favour of boys..... There was some indiction that boys excelled in higher level cognitive tasks".

Callahan and Glennon (1975) agreed with these conclusions, and have suggested that conflicting results probably reflect the nature of the mathematical tasks involved, since there is a tendency for girls to do slightly better than boys on low level cognitive tasks such as computation while boys do better on higher cognitive tasks such as tests of arithmetic reasoning. However, Senk and Vsiskin (1983) found differently. In a study of 1,364 students in 74 senior high school classes in US in which geometry proof was taught, they found equal ability among males and females in writing geometry proofs. These results held as well for selected high achieving subsamples. From these findings, and from data from other recent studies, they suggested that:-

> "Girls and boys perform equally well even on complex mathematical tasks if both in-class and out-of-class exposure to the tasks is equal".

Swafford (1980) also found that there are no sex differences in algebra achievement among first year algebra students in US.

Wood (1976) analysed the results of the London Board "O" level mathematics examination (in which the syllabus combines what could be called 'modern' and 'traditional' elements although it is meant to be regarded as a unified syllabus); the examination consists of two papers, one multiple choice and the other free response. Responses to the questions set in the June 1973 and June 1974 examination papers were analysed for boys and girls separately. The analysis was based on samples of boys and girls drawn from the same mixed schools - 493 boys and 478 girls in 1973 and 507 boys and 406 girls in 1974. He indicated that:-

> "The item that showed the biggest (margin) in favour of boys - 42% - was an almost pure measure of ability to visualize in three dimensions..... It is generally believed that boys are better than girls at mathematics. And the study reveals that on the whole boys do perform better, on both multiple choice and free response types of question, but that at the question level most of the differences may be removable through schooling".

Fennema (1978) concluded, from the review of many studies that:-

> "The evidence would suggest to the teacher that boys will achieve higher than girls on tests dealing with mathematical reasoning".

Then Badger (1981) indicated that:-

> "Girls generally score less well than boys on tests that aggregate results over a variety of mathematical topics. Their relatively poor performance is not unconditional".

Therefore, it can be concluded that most studies indicate that boys are better than girls in high level cognitive tasks and especially in spatial visualization and tend, in general, to score higher than girls on the tests that have been administered in the studies, especially those dealing with mathematical reasoning.

Most studies carried out at the primary school level found that there are no sex differences in achievement and attitude towards mathematics, and when they found those differences, the results varied: in some girls excelled and in others boys did. Fennema (1974) has summed up the usual findings as far as the early school years are concerned by stating:-

> "It appears reasonable to conclude that there are no consistent significant differences in the learning of mathematics by boys and girls in the early elementary years".

This also appears to be the conclusion of other reviewers such as Callahan and Glennon (1975) supporting the opinion that there are no sex differences in elementary schools. Badger (1981) stated that:-

> "Up until adolescence girls and boys show no more differences in mathematics achievement than they show in general intelligence, basically their scores are comparable".

This finding was supported by Fennema (1974). At the same time most of the studies concluded that the real differences between the sexes in their attitude towards and achievement in mathematics started at the secondary and high school stages, i.e. over the range of 12-15 years of age. Armstrong (1980) stated that:-

> "It is generally accepted that elementary school girls excel in arithmetic and science. However the picture begins to change in junior high school as boys overtake and pass their female contemporaries in mathematics achievement".

Fox and Cohn (1980) and Smith and Stuart (1980) reached the same conclusions as Armstrong. Doe (1980) differed slightly, when he analysed the results of Government Assessment of Performance Unit, test in Mathematics by 13,000, 11 year olds from 1,000 schools in the UK, found that, boys performance was slightly superior to girls in all categories except in computation where girls were markedly better.

The differences during the secondary school years have been regularly reported. France (1964), reported that at the British secondary school stage, although the differences in mathematics scores between the average boys and girls were not so great, however, boys were still better than girls. Maccoby and Jacklin (1974) from their comprehensive review of sex differences concluded that:-

> "From the age of about 12 to 13 years boys excel at spatial-visualization and mathematical tasks".

Convincing evidence of sex differences in mathematics was reported by Husén (1967) who analysed the results of the first International Association for the Evaluation of Educational Achievement (IEA) mathematics study. This was conducted in 12 countries, whereby students from two population levels (13-year olds and final year secondary) were tested on especially constructed achievement tests. It was concluded that there are sex differences and that these favour boys. Hilton and Berglund (1974) concluded that there were no sex differences in mathematics achievement at grade 5 level. However, at subsequent grade levels (grades 7, 9, 11) males have higher mean scores than females and the differences between the sexes increase with age. Armstrong (1980) agreed with Hilton and Berglund. Badger (1981) also indicated that in their early teens girls' performance begins to decline in relation to boys until, by the end of compulsory schooling there is a dramatic difference between the sexes in their mathematical competence as well as in their training and qualification. Girls not only fail to continue their study, but their rate of success in all mathematical work is generally lower than that of boys. Cornelius and Cockburn (1978) examined the "O" level performance of 1,152 students in one district, and found that the average grade of boys was significantly better than that of the girls in the maths/science subjects (e.g. 2.77 vs 2.34 for those taking

mathematics exams). Girls were superior in english, religion, languages and commercial subjects.

However, some researchers differed with the above. For example, Lee (1955) in her study of specific ability and attainment in mathematics at secondary school stage, using boys and girls in one co-educational British Grammar School in which they were taught alongside one another by the same teacher, found that there is no difference in either mathematical ability or attainment between boys and girls. Arvidson (1956) supported Lee's findings.

Wozencraft (1963) in her study divided samples of third and sixth grades according to their intelligence quotients into three groups: low, average and high. The low group ranged from 55 to 89 I Q the average group ranged from 90 to 109, and the high 110 IQ and over. The result showed that at 12 years of age there is no difference between the sexes in arithmetic reasoning; while girls are slightly ahead of boys at twelve in tests of arithmetic computation in the average group only.

To summarize the above, there seems to exist a good deal of agreement that at the primary school level there are no sex differences in mathematical learning, while at the secondary school level boys surpass girls in mathematics learning and ability. Largely through the IEA study, these findings are known to hold in a range of countries.

2.1.3 Sex Differences in Participation and Career Orientation

Most studies and authors have found the proportion of girls who have enrolled in high-school science and mathematics courses and who have their careers orientated towards mathematics and science to be low. The mathematics study (Husén, 1967) found sex differences in mathematics participation in nearly every country studied. More than twice as many males as females were mathematics specialists across the 12 countries studied, including the United States. The most comprehensive study on the role of women in higher education is the Carnegie Commission's Report on US campuses that appeared in 1973. The data for the report was collected between 1969 and

1972. In addition to this data, the report studied the trend of changes during the century. The Commission concluded that there has been an overall decline in the representation of women in college and university faculties over the span from 1930 to 1970. Although the trend of decline in representation of women on university faculties migh have slowed down and probably reversed in the seventies, yet the imbalance in the distribution of the sexes in many faculties is still impressive. Unfortunately, the study does not report the percentages of women in the field of mathematics separately. Mathematics is included under the heading of "physical sciences" covering the natural sciences, computer science and statistics.

Keeves (1973) from evidence collected in ten countries by the IEA mathematics and science projects in 1964 and 1970 respectively, stated that:-

> "We find that there are differences in participation rates between the sexes at the terminal secondary school and at the first year university levels, as well as in the study of mathematics and science, and in general, boys had a slightly greater opportunity to learn the items tested than girls".

Badger (1981) reported statistics, shown in table 2.2 ,which give some indication of the situation for school leavers as it exists in England, Wales, and Northern Ireland.

Table 2.2 Result of Summer Mathematics Examination (1978 School Leavers)

Subject	Attempted	Percentage Passed
CSE Arithmetic	Boys: 17,833	2.9*
	Girls: 19,715	2.5*
CSE Mathematics	Boys: 202,278	15.6*
	Girls: 207,767	12.3*
GCE 'O' level Mathematics	Boys: 211,910	61.0[1]
	Girls: 145,508	52.0[1]

* Grade 1 pass
[1] Grade A-C

Source: Department of Education and Science (1978) Statistics of Education: Vol. 2, School Leavers CSE and GCE, London HMSO.

From the statistics, it is evident that, while approximately equal numbers of boys and girls have entered for the CSE arithmetic and mathematics examination, a disproportionately small number of girls are entered for the GCE O-level mathematics examination. At the same time Harding (1981) found the same as Badger. He examined the national figures for boys and girls entry and pass rates for the 1974 CSE and O-level exams. Although mathematics is effectively a compulsory subject, fewer girls than boys attempted O-levels in mathematics, instead they were doing CSE. He concluded that:-

> "Actually more girls took O-levels in Biology than in Maths".

Russell (1984) noticed that in Bradford upper schools in 1981-82 there were 1165 students on 'A' level courses in first year sixth forms, 604 boys and 561 girls. It was found that 56% of these boys had chosen 'A' level mathematics, while only 22% of the girls had chosen the subject. In the US,Pedro et al. (1981) stated that males more than females elect advanced mathematics courses, and they concluded that:-

> "Their differential in the number of mathematics courses elected has been cited as a major explanation of sex-related differences in adults' mathematics performance and in their participation in mathematics related careers".

Casserly (1975) observed that:-

> "In the physical sciences, mathematics, and related fields, professional and college-level output is limited by the pool of students in these areas at the secondary school level. If we are concerned with national sources of professional talent, we would hope to find girls represented in their natural proportion to boys in the initial pool. Unfortunately, relatively few girls are enrolled in high-school science and mathematics courses".

Kirk (1975), in his study of sex-related differences in mathematics achievement in the US, concluded that:-

> "Frequency of science-boundness is clearly greater for young men, especially so for espousal of mathematics. The young women are more likely to favour biological sciences".

Levine (1976), in his analysis of reasons behind women not pursuing mathematical careers, concluded that:-

> "Statistical results and anectotal reports supported the conjecture that there is a decrease in girls' interest in mathematics and sharp increase in societal pressure against women in mathematics during the students high school years".

Fennema and Sherman (1977), in their study of sex related differences in mathematics achievement in US, found that females did not continue in the mathematics study sequence as often as males, and that, although more boys took a terminal mathematics course in the 9th grade, an even higher proportion of boys went on to be enrolled in mathematics classes in the 11th and 12th grades. Atweh (1980) summarized that:-

> "In general, males tend to take more mathematics at high school and beyond than do females".

Leder (1982) studied sex differences in mathematics achievement and participation among 250 boys and 233 girls from 20 classes in 11 randomly selected co-educational schools in the metropolitan area of Melbourne, Victoria; of these, 68 boys and 87 girls were in grade 7, 133 boys and 114 girls in grade 10, and 57 boys and 32 girls were in grade 11. He found at both grades 10 and 11 levels, proportionately more boys than girls intended to continue with mathematics subjects, whereas proportionately more girls than boys intended to opt out of mathematics courses altogether.

In contrast to the above findings, Dekkers et al. (1983) found differently in Australian secondary schools. They described male/female enrolment trends in mathematics in Australian schools over the period 1970-1979. Their data indicated that there has been a marked increase in the number of students studying mathematics in Queensland and Western Australia over those years, with marginal increase in each of the other States except Tasmania where there has been an overall decline in numbers. The most significant trend to emerge from their data is the steady increase in female mathematics enrolment.

Therefore, it can be concluded that most studies confirm that boys and girls' interest, participation and career orientation differ significantly. Boys are

generally more interested in mathematics; a higher proportion of boys take mathematics and science orientated subjects and their career interests are more directed towards the physical science, while girls are more oriented towards the social sciences and languages and if their orientation is scientific, then ,it is mainly towards the biological sciences.

2.2 The Relevant Factors

The factors affecting the phenomenon of sex differences in mathematics may be classified as follows:-

2.2.1- Cognitive factors

2.2.2- Affective factors

2.2.3- Environmental factors

This classification should not be taken as reflecting any independence between the factors, but as an arbitrary one, proposed for the sake of clarity and to achieve a better flow of argument. In reality the above factors would interact continually with each other and have a high degree of overlap between them.

It is hoped that an analysis of the above factors will provide insights about the reasons for the sex differences in mathematics in performance and attitude which have been discussed in section 2.1. The literature covering the above factors will be covered in sequence.

2.2.1 Cognitive Factors

It has been suggested that there are certain differences in cognitive functioning between the sexes which may result in lessening the appeal of mathematics to girls. These differences between the sexes have been widely reviewed; Buffery and Gray (1972) reported from many studies that the evidence that males are superior to females in the performance of tasks requiring perception, judgement and the manipulation of spatial relationships, is very strong. However, women are

superior to men in at least some verbal skills. Maccoby and Jacklin (1974) reported that the average score of group of males is often somewhat higher on tests measuring spatial visualization than is the average score of group of females, but that females excel in verbal ability in the general population.

Kelly (1976), in her bibliographic review indicated that men generally do better than women in tests of numerical ability, spatial ability and problem solving. On the other hand, girls are generally considered to be better on tests of verbal ability, and she cited evidence to support this proposition.

Atweh (1980) noted that many research projects have shown that verbal ability in females develops earlier than in males, and that noticeable differences start to appear at about age 11 with female superiority increasing throughout the high school and later years.

> Sherman (1981) stated that:-
> "It has been hypothesized that divergent sex role behaviours (blocks, aiming games, models, finding the way, chess, courses in drafting) serve to develop spatial skill less in females than in males and that differences between the sexes in spatial skill then has unexpected ramifications in other areas of behaviour, i.e. mathematics".

Hence, the studies seem to suggest that males are superior to girls in spatial visualization and females are superior in verbral ability; and that these differences become apparent after the age of 11.

But, what is the relationship between spatial visualization and mathematics ability? The empirical evidence for the suggestion that the differences in spatial skills account for observed sex differences in mathematics achievement and participation is inconclusive (Fennema, 1978). A further interpretative problem arises from the finding that for females but not for males, spatial visualization scores predict later mathematical scores on geometry and problem solving (Sherman, 1979) and course taking (Sherman, 1981). However, some studies have indicated that the relationship is very strong; for example, Fennema and Sherman (1977) controlled for mathematics background and general ability in predicting twelfth grade scores from

data collected in the ninth grade in the US. Males scored higher on spatial visualization and the correlations between mathematics achievement and spatial visualization were as high as the correlations between mathematics achievement and verbal measures.

Aiken (1973) concluded that spatial-perceptual ability was one of the most salient mathematical factors extracted in various investigation.

Sherman (1981) studied 331 American high school students; they were extensively tested in their first year and were followed up as seniors to see what courses in theoretical mathematics they had elected. The results of her study have confirmed the expectation that spatial visualization was a more important factor in differentiating females who were following more or less theoretical mathematics, than for males. The discriminant weight for females was 0.36 while it was 0.01 for males.

On the other hand, some investigations have concluded that spatial skills and the learning of mathematics are definitely not related. For example, Very (1967) stated that:-

> "Research on spatial ability failed to produce any significant correlation of the spatial factor with any facet of mathematics performance".

So, what are the reasons for the differences between the sexes in cognitive abilities? Buffery and Gray (1972) advocated a physiological basis for differing cognitive abilities, imparticular spatial skills. They suggested a genetic component to spatial abilities, being under the control of the sex chromosomes, arguing that there is evidence to suggest that a recessive gene determining superior visuo-spatial ability is carried on the x chromosome.

Sherman (1978) came to a different conclusion, namely that the sexual divergence in development of spatial skill is due to cultural influence and not to incorrigible biological factors, although indirect and historical influences stemming from these factors cannot be ruled out.

The environmental influence as a cause for the differences in cognitive

abilities has been mentioned in most studies; because of the proposition that cultural factors influence what the child should learn at each age, and that different environments lead to the development of different ability patterns. For example, in the first IEA mathematics study (Husen, 1967) the degree and pattern of male superiority varied across countries and this variation must mean that the differences in performance between males and females cannot be attributed to sex alone. This most important study provides evidence for hupothesizing a cultural origin of the differences. However, on the basis of the results of the IEA study it seems reasonable to attempt to link differences in achievement to sex-role perceptions and socialization practices in different countries. These may effect the different responses of males and females to mathematics learning regardless of developed or potential ability.

Keeves (1972) studied a sample of children in the Australian Capital Territory who were in year 6 (of primary school) in 1968. Data was collected on their home environment variables and a further study was made in 1969 when these students were at secondary school. At year 6, the parents reported that boys were given greater freedom of exploration, more encouragement to discuss a wide range of topics and that there was also greater pressure on them to achieve through working at home. Also, there were significant differences between boys and girls as to the ambitions expressed by both the mothers and fathers, with higher levels of ambitions expressed for the boys with regard to future education and occupation. Subsequently, at year 7, the boys expressed more favourable attitudes towards mathematics and science than girls.

It could be concluded that there seem to be significant differences in spatial-perceptual ability between the sexes, and that this ability has some impact on the individual's mathematical ability. However, evidence is more supportive of the greater influence of environmental variables on cognitive ability. It seems that sex-role perceptions and socialization practices have the greatest negative impact on the attitude of females towards science in general and mathematics in particular, irrespective of

their potential or developed abilities.

2.2.2 Affective Factors

These factors cover the socio-cultural variables that influence the sexes in their attitude towards, and achievement in, mathematics. Many studies have covered these variables with remarkably similar results. They will be reviewed under the four principal dimensions of:-

A- The confidence-anxiety dimension in mathematics

B- Stereotyping mathematics as a male domain

C- Perception of the usefulness of mathematics

D- Social roles and perception

A- The confidence anxiety deminsion in mathematics

One tends to do things that one feels confident to do and avoid activities that arouse anxiety. This confidence-anxiety dimension, as it relates to mathematics learning, is one of the more important affective variables that helps to explain sex-related differences in larning. Fennema (1978) stated that:-

> "The literature strongly supports the belief that there are sex-related differences in confidence and anxiety. It appears reasonable to believe that lesser confidence or greater anxiety, on the part of females is an important variable that helps explain sex-related differences in mathematics course-taking".

Similarly, Armstrong (1980) stated that:-

> "Enjoyment, confidence and anxiety about mathematics combine to reflect the students' attitudes towards mathematics, especially girls".

But the findings of Perl (1982) differ on this dimension. He used the data of the US National Longitudinal Study of Mathematics Achievement (NLSMA); based on longitudinal observation of two groups of high school students, one group of approximately 22,000 students was followed from 10th through 12th grade (called Z population) the second, about 40,000 students, was studied from 7th through 11th

grade (called Y population). He found that the negative attitudes factor, comprised of the confidence and anxiety scales, does not appear as a discriminating factor between mathematics electors and nonelectors, for either girls or boys, in either sample, or even when electors versus nonelectors are compared overall for either pupulation. Although singificant sex differences in the debilitating anxiety scale are present, with girls more anxious than boys, this factor seems to have no directly discernible effect on the electing process. However, his findings about the other variables which influence students' decisions to study mathematics were in agreement with Fennema (1977) and Armstrong (1980).

Some studies suggested that the relationship between 'anxiety' on its own and mathematics achievement is very strong, for example Aiken (1970) stated that the result of several investigations suggested that measures of attitude and anxiety may be better predictors of the achievement of females than of males. Callahan and Glennon (1975) concluded that:-

> "Anxiety and mathematics are related..... In general high anxiety is associated with lower achievement in mathematics"

Atweh (1980) reported that when US high school graduates were asked to predict their ability to handle higher-level mathematics, more boys than girls were sure that they would be able to handle higher mathematics even though the mean performance of the group on mathematics marticulation examination was identical. He concluded that:-

> "Females, in general, express greater anxiety and lower confidence in handling further mathematics subjects than males of comparable ability..... Females in our society avoid mathematical studies and reveal anxiety in studying and using mathematics to a greater extent than males".

The findings of Perdo et al. (1981) supported Atewh's conclusions.

Confidence, as related to mathematics has not been given specific attention. However, self-concept, which appears to be defined in many scales as

self-confidence, has received much study. Callahan and Glennon (1975) stated that:-

> "There is a positive relationship between self-esteem and acheivement in mathematics".

Kelly (1974) stated that:-

> "Girls are known to be less self-confident about their abilities than boys and it may be that they choose biology at an early stage in school before they realize that university is a real possibility".

Badger (1981) noted that:-

> "Girls relative lack of self-confidence in their mathematical ability is a consistent finding in the literature, as is their withdrawal from mathematical activities".

Kelly (1976) stated that:-

> "Girls perceive themselves as less independent than boys and lack confidence in their own intellectual abilities".

Luchins and Luchins (1980) stated that:-

> "Females tended to be less confident about themselves, their abilities and their contributions than men..... There is a need for some change in attitudes of female mathematicians toward mathematics and their work".

However, Fennema and Sherman (1977) went further than the rest in attributing higher importance to confidence as related to mathematics learning. They found in their study conducted in US Secondary Schools that confidence in one's ability to learn mathematics constitutes a critical dimension in explaining sex-related performance in mathematics. The two distinct measures of anxiety and confidence correlated very highly with each other so that for practical reasons they could be considered identical, that is, high anxiety implied low confidence and vice-versa. Significant sex-related differences in achievement occurred only in those schools in which differences in affective measures were also evident. In particular, girls were less confident than boys in these schools and confidence correlated almost as highly with mathematics achievement as did verbal and spatial ability. In another study Sherman (1979) stated that:-

> "Confidence in learning mathematics correlated nearly as highly with mathematics achievement as did vocabulary and spatial visualization".

Could the poor achievement of girls in mathematics be attributed to the proposition that there is an underlying motive to avoid success? Moss (1982) noted, from many studies in this area, that:-

> "This motive is assumed to be a function of a fear that negative consequences such as loss of femininity will result from success in competitive achievement situations. Mathematics is particularly threatening because it is traditionally a male domain..... There is evidence both direct and indirect, of the effect of this motive to avoid success".

Fitzpatrick (1978) studied groups of tenth grade girls of above average general ability and found that the degree of influence of others' opinions on the girls' goals and motives had a significant effect on mathematics achievement, but not on verbal achievement. This he suggested could be related to "fear of success".

B- Stereotyping mathematics as a male domain

It is commonly accepted that mathematics and science are stereotyped as an activity more apropriate for males than for females. The findings of Heilbrun (1963), support the hypothesis that, the greater the feminine sex-role adoption of the late adolescent, the more the sex-role confusion to be found among those who participate in a competitive program of higher-education. Kelly (1976) stated that:-

> "At school and at work science has a masculine image, and is often rejected as unsuitable for girls; boys are encouraged from early childhood to take an interest in mechanical and scientific things, but girls are not".

When members of US association for women in mathematics were asked by Luchins and Luchins (1980), why there are, and have been, relatively few female mathematicians as "masculine, not feminine". They pointed out that women are not encouraged to think in terms of mathematical careers and that they are treated differently.

Ormerod and Duckworth (1976) in their review of many studies

concluded that:-

> "Girls feel that science and mathematics are boys' subjects and find that their boy friends are incredulous when they elect to study chemistry, physics, and mathematics".

These conclusions were supported by Fennema (1980). Fennema and Sherman (1977) indicated that:-

> "Females in grade six through twelve deny that males in the study did not strongly stereotype mathematics as a male domain at each grade. They stereotyped it at significantly higher levels than did females. The cross-sex influence on all aspects of behaviour is strong during adolescent years. Since males stereotype mathematics as a male domain, they undoubtedly communicate this belief in many subtle and not so subtle ways to females, which influences females' willingness to study mathematics".

Sherman and Fennema (1977) confirmed these findings. Fennema (1978) stated that:-

> "It has been believed that the sex typing of mathematics as male began in elementary school, came stronger during adolescent years and was solidly entrenched by adult years".

She also noted that higher school boys are more likely than not to agree with stereotyped statements about mathematics as a male domain.

At the same time Fitzpatrick (1978) suggested that as girls pick up the notion that mathematics is a masculine area of expertise those who are more subject to influence of others perform less well in the mathematical area than do those who are less succeptible to the opinions of their peers. Brody and Fox (1980) stated that:-

> "Because of a perception that mathematics is a male domain more appropriate for men than for women, girls receive less encouragement than boys do to take advanced mathematical and scientific fields".

Sherman (1979) also reported on a longitudinal study in which ninth grade American girls who subsequently enrolled in a fourth year of theoretical mathematics (12 years) showed less positive attitudes toward success in mathematics and stereotyped mathematics as a male domain than did the overall groups of girls with two or three

years of theoretical mathematics. Badger (1981) stated that:-

> "Girls generally tend to underestimate their performance , this tendency is particularly apparent in regard to 'male' activities which includes mathematics. In actual terms, girl's relative success in the subject is related to their denial of mathematics as a male domain".

C- Perception of the usefulness of mathematics

Another factor which may affect sex differences is belief in the personal usefulness of mathematics. Fennema and Sherman (1977) provided data indicating that females believe that mathematics is personally useful to a lesser degree than do males. Fennema (1979) reported that:-

> "Girls in secondary schools indicated that they did not feel they would use mathematics in future where-as boys were more likely to report that mathematics was essential for whatever career they planned".

Armstrong (1980) noted that many studies suggested that:-

> "Women who believe that mathematics would be useful in their future studies are much more likely to continue to take mathematics courses".

Atweh (1980) concluded that:-

> "Females, in general, do not see mathematics as relevant to their aspiration for careers".

Russell (1984) in her study attempted to find some of the reasons for the magnitude of the differences between boys and girls in choosing mathematics. She was able to obtain responses to a questionnaire from 299 students (128 who were studying mathematics and 171 who were not). The students were asked to rate the subjects that they had studied at 'O' level for 'usefulness'; she found that the girls did not see mathematics as such a useful subject as the boys did, and also it appears that neither boys nor girls regarded the content of the 'O' level mathematics syllabus as particularly useful, but boys saw the qualification in mathematics as more useful for their intended careers. She noted that:-

> "Whereas a boy is usually counselled to work towards a qualification in mathematics as a career essential, this is not always the case with girls".

Iker (1980) reviewed many research studies dealing with the question of why fewer girls take mathematics, and noted that:-

> "The single most important determinant in the decision to take advanced mathematics is whether a girl believes that mathematics will be useful to her in the future".

D- Social roles and perception

There is evidence suggesting that both sexes are aware of the social implications of mathematics, but girls may be more sensitive to these. This sensitivity has been indicated as a possible factor contributing to the lack of popularity of mathematics with girls.

The research findings of Nevin (1973) proposed that a young woman's strong interest in human relationships mediates against a potential interest in such subjects as mathematics. More recent studies by Fennema (1976) support this hypothesis and conclude that differential mathematics achievement and attitude in the sexes is partially caused by sociocultural factors mediated through sex-role expectations. Kelly (1976) in her extensive review of British, American and Australian research, concluded that:-

> "Students of both sexes studying arts or social science are more concerned than are science students about working with people, and the difference is greater for women than for men.... Girls have little idea what career in science involves, girls want a career dealing with people but they see science as being concerned with things. Further, women still have to choose, if not between marriage and a career, then between children and a career".

Duckworth (1974) quoted a speech given by a head mistress to a meeting of the Royal Society convened to discuss the swing from science which, suggested that social acceptability is a very important influence on the choice of subjects; that girls feel that

science and mathematics are boys' subjects; and that girls are deterred because they feel that science and marriage do not mix.

However, girls' attitudes to science and mathematics take a different turn when it comes to biology. Biology seems to be very popular with girls (Kelly, 1974). Ebbutt (1981) supported this, he conducted a case study on 3rd year British girls as to factors related to their science subject choices for subsequent years. He interviewed seven science teachers as to their theories of why girls took biology as compulsory science. Many mentioned that biology was more interesting to girls (e.g. the study of human anatomy suited girls' development stage); more career relevant (e.g. nursing); and received more positive press from parents, friends and teachers. The girl students agreed with these factors.

Another aspect is society's attitudes towards the pursuit of science and mathematics education by the sexes. This attitude is reflected in the provision of resources. Byrne (1975) researched sex inequalities in the provision of resources in the UK. In a survey of 133 schools, some mixed and some single-sex, she found inequalities in the provision of finance materials and in staffing levels. She also found that, 'almost all' the girls' schools had too few laboratories, and that, in all but four, the girls were taught biology in an ordinary classroom while boys did science in a laboratory. There were also inequalities in the provision of craft and vocational facilities. Even where facilities are equal, schools may divide pupils on the basis of their sex.

In discouraging girls from mathematical education, Brody and Fox (1980) stated that:-

> "Books and media contribute to the perception of mathematics as a male domain and thereby discourage girls from entering it".

As to society's general attitude, Atweh (1980) outlined it thus:-

> "Traditionally society has not expected girls to pursue and achieve in mathematics to the same level as boys and in some instances presents forces that act against such achievement or participation".

Keeves (1973), after a careful and thorough review of mathematics and science education in ten countries, concluded that:-

> "The extent to which a community provides for education in single-sex schools would appear to indicate the extent to which it sees its boys and girls requiring different preparation for different societal roles".

He argued that:-

> "In so far as a community has different expectation for different groups of its members and proceeds to mold its future members through different organization, then it fails to provide equal opportunities for individual development".

The school environment has also been identified to be discouraging for girls to study mathematics. For example, Becker's (1981) study of US classroom environments, found that the classroom environment was more supportive of males academically and emotionally, and that teachers, community, and school beliefs and values compounded the impression that mathematics is not a subject in which women have an active role.

Fennema (1978) indicated that, in most US traditional schools, boys became leaders in problem solving, while girls became followers this was not so in the less traditional schools (the sex-role behaviour of children attending traditional schools was more rigid than that of children attending liberal schools).

Discouragement may be implanted easily in the school years; in reviewing women in science Kelly (1976), concluded that:-

> "In addition, boys are encouraged from early childhood to take an interest in mechanical, and scientific things, fly model areoplanes, help with car, etc., whereas much of the girls pre school socialization has the effect of leading them away from science".

Iker (1980) stated that:-

> "It all may start in the nursery, where little girls are traditionally given dolls to play with while little boys more often get building blocks or construction toys".

Hence, the above studies seem to suggest that the net effect of social roles and perception is negative, with respect to girl's encouragement to undertake maths education. However, for affective factors as a whole, it can be concluded that these factors play a significant role in deciding the sex differences in attitudes towards and achievement in mathematics especially at the post-primary stages.

Most studies found that girls display higher anxiety and lower confidence towards mathematics than boys and that girls are generally less motivated to succeed in competitive environment and in domains that they perceive to be exclusive for males such as mathematics. Also, the studies seem to support the proposition that girls perceive mathematics to be less useful for their goals and careers than boys. Also, the studies seem to indicate that sex role differentiation, society's attitude and perceptions, and the school and class environments, are all inclined towards the discouragement of girls to pursue science education in general and maths education in particular.

2.2.3 Environmental Factors

These factors cover all the variables that determine the educational and the background environment of the pupils. They may be divided into: teacher, parents, and curriculum influences respectively; these will be treated in turn.

A- Teacher's influence

Most studies found that teachers are important, and that they make a major impact on students' feelings about mathematics as well as on their learning of mathematics. How teachers treat pupils and teachers abilities and attitudes are very important in influencing the attitude of pupils toward mathematics ,since pupils tend to be swayed by what they believe their teachers think of them and of their ability in mathematics.

Most of the studies which concentrated on the attitude of girls towards mathematics, found that they receive less encouragement by their teachers than boys. For example, Fennema (1980) in her literature review, looked at some ways that

teachers can improve the mathematics education of girls, as well as that of boys, stated that:-

> "There is much evidence to indicate that teachers are differentially influencing females and males in their learning and feeling toward mathematics. Partly as result of this differential treatment, females, to much greater extent than males, are receiving inadequate mathematical education in high school.... In many subtle ways, teachers treat females differently than they do males, and this differential treatment is a negative influence on females' studying of mathematics".

She went on to indicate that by spending more time with males, teachers are not only helping males more, but they are communicating, albeit subtly, that males' concerns in mathematics are more important than females' concerns, and that mathematics learning is more essential for males than for females. Finally she indicated that teachers reinforce or reward males and females for different types of behaviour. Males are rewarded for behaviour stereotyped as male, and females are rewarded for behaviour stereotyped as female.

Luchins and Luchins (1980) conducted a study in 1975 in which a questionnaire was sent to members of the US Association for Women in Mathematics and their responses were compared with a small sample of male mathematicians who answered the same questions. They found that two thirds of both groups recalled being encouraged by a teacher, although this encouragement was uneven, especially for women, where some of them stated that at pre-college stage, their teachers paid more attention to the boys or expected less of the girls.

Brody and Fox (1980), summed up the nature of the differences in encouragement between the sexes thus:-

> "Another factor that may contribute to sex differences in mathematics course-taking is differential encouragement by significant others. Because of perception that mathematics is a male domain more appropriate for men than for women, girls receive less encouragement than boys do to take advanced mathematics courses and to consider careers in mathematical and scientific fields. The significant others include teachers, parents".

Also, Becker (1981) studied the differential treatment of females and males in mathematics classes, he found that, in general, females experienced a lack of

encouragement and were actively discouraged at times. All ten teachers who were observed in his study showed more encouragement of males, even teachers who were fairly balanced in other interactions with students, tended to give males more encouragement. He also found that related to the encouragement of academic abilities and pursuits in mathematics is the teacher's willingness to persist with a student who has not answered a question satisfactorily. In the longest example of this category, the teacher spent more than 15 minutes of class time with one male student, asking him questions and giving him hints and clues, until he finally got a proof on the board correct. The rest of the class were just an audience. Becker concluded that teachers seemed more willing to persist with male students. Gore and Roumagoux (1983), in a study of UK students carried out in 1979, supported Becker's findings especially as to the differences in wait-times teachers are prepared to give to pupils.

Russell's (1984) study attempted to find some of the reasons for the magnitude of sex differences in course-taking in mathematics among British students. She found that encouragement by their teachers, or the lack of it, was seen as important by many girls describing their attitudes to the subject. This was a stronger influence for girls than for boys. Burton (1984) reflected the importance of teacher encouragement when he stated that:-

> "If the numbers of young women and minority students whose participation in non-required mathematics courses and in mathematics and science careers is to increase, teachers must argue, inspire, prompt, motivate and entice these students to elect mathematics courses. When a student expresses a desire to do so, teachers should signal pleasure and offer encouragement".

Some studies have concentrated on the influence of the teacher's attitude and expectation, Aiken and Dreger (1961) stated that:-

> "Maths attitude are apparently related to remembered impression of teachers, the female more clearly so than the male attitude.... Experiences and attitude with former mathematics teachers are somewhat related to present maths attitudes".

Aiken (1970) also indicated that:-

> "It is generally held that teacher attitude and effectiveness in a particular subject are improtant determinants of girls' attitude and performance in that subject".

Becker (1981) found that teachers have different expectations of students based on their sex, and that, differential expectation for each sex includes ability in mathematics, social behaviour, and maturity. They indicated that teachers treat students differently on the basis of sex in ways consistent with these expectations.

On the other hand, some studies indicate that the abilities of teachers are important to the attitude of both sexes toward mathematics, for example, Sheeham and Marcus (1977) in their study of the relationship between the performance of teachers and their students' mathematics and vocabulary achievement found that higher teacher's WCET (Weighted Common Examination Total) scores were associated with significantly higher levels of students' mathematics and vocabulary achievement and were significantly related to effective teaching.

However it is unfair to indicate too strongly that teachers are the sole creators of girls' negative attitudes toward mathematics, although the results of research have suggested that the teacher, perhaps even more than the parents, is an important determinant of girls' attitudes. However, that does not mean that the influence of parents is not important. Indeed many studies have indicated that the encouragement and expectations of parents do strongly influence the attitude of girls towards mathematics.

B- Parents' influence

In some studies the expectation of parents are advocated to be very important influences on sex differences toward mathematics. Maccoby and Jacklin (1974) reviewed the literature on childhood socialization experiences and concluded that:-

> "There is a great deal of similarity in the early socialization experiences of boys and girls. Subtle differences exist, however, in that parents often have lower educational expectations for daughters than for sons and reinforce sex-role

stereotypes in their choice of toys or by their greater acceptance of low levels of achievement in mathematics".

Fox (1976) stated that:-

"The expectation of father, but not his attitude or occupation, influenced mathematics achievement for girls".

Other studies have indicated that encouragement from parents is a very important influence if girls are to do better in mathematics and change their attitude towards it. Maccoby and Jacklin (1974) reviewed evidence that parents tend not only to encourage their children to develop sex-typed interests but even to discourage them from participating in activities which they considered more appropriate for the opposite sex, and they stated that:-

"A fear of success in such activities clearly could be a consequence of this parental influence".

In the study of Fennema and Sherman (1977), ninth grade girls reported significantly less positive perceptions of their parents' opinions of them as learners of mathematics than did boys. Also Fennema and Sherman (1977b) evaluated the role of parents as follows:-

"Parents perceive mathematics to be more appropriate for boys than for girls, and by their actions parents offer more encouragement to boys than to girls to learn mathematics. Parents report buying more mathematical games for boys and offering mroe explicit reward and reinforcement to their sons to learn mathematics than to their daughters".

Iker (1980), stated that:-

"Parents, often deliberately, but not unconsiously, too, help to create such attitudes by offering more encouragement to sons than to daughters to excel in maths. In addition, more often than not, its the father rather than the mother who helps a child with maths homework".

In their study of mathematically gifted girls, Brody and Fox (1980)

reported that:-

> "Parents of gifted girls were less likely to view a career in mathematics or science as appropriate for their child than were parents of gifted boys".

On the other hand, several women who are mathematicians and most of the girls taking advanced placement courses in the Casserly (1975) study felt that parental or family support had been favourable. It seems likely that early and sustained support and encouragement in the home can be very potent.

Other studies concentrated on the influence of the background of the family, for example, the study of Alani (1978) of attitude and achievement in mathematics of a sample of Iraqi Secondary School pupils found that there is a significant sex by socioeconomic background (income of parents) interaction. Boys did better than girls at upper middle class level, while girls did better than boys at the middle class level. Tsai and Walberg (1983) indicated that the family background of the student is influential in learning, even in the subject of mathematics, which may appear to be learned exclusively in school, stating that:-

> "The stimulation offered by parents of higher education together with verbal materials such as books and magazines are conducive not only to reading but to mathematics achievement and motivation as well".

C- <u>The curriculum influence</u>

The curriculum has been confirmed as a very important variable in influencing the attitude of pupils towards mathematics. For examples, the Gloucestershire Education Committee Science advisory group (1971) report concluded that:-

> "The subject material is of greater importance than the teacher himself in determining pupils liking or disliking of a subject".

Some studies have suggested that, girls, in general, do not get interested in subjects which do not deal with people and daily life. Also they regard mathematics as one of the most difficult subjects since most of its contents depend on theoretical

and symbolic formulation and do not deal with life and people. Kelly (1974) stated that:-

> "It is often suggested that biology appeals to girls because it is 'nurturative' and concerned with people".

And Leder (1974) noted that:-

> "Mathematics text books tended to be biased toward the traditional interests of men".

Brody and Fox (1980) stated that:-

> "The gifted girls need special encouragement and programs to counteract the image of mathematics as more relevant for men than for women and to show them how the study of mathematics may be relevant to wide variety of college majors and career including those in the social sciences".

Atweh (1980) reported that there is sexual stereotyping in many mathematics text books, and that mathematics text books share the problems regarding sexism with other text books: girls are potrayed as passive, boys as active; girls are shown in pictures sewing, mopping, baking whereas boys are playing ball and riding bicycles; and, girls are portrayed as affectionate, easily frightened while boys are stronger and never cry.

In addition to all these problems, mathematics text books have traditionally omitted the mention of female mathematicians. Sherman (1983), concluded that the study of mathematics is one of the most male sextyped subjects of the college preparatory curriculum.

However, some other studies have concentrated on the difficulty of the subject of mathematics, for example, Keys and Ormerod (1976) stated that:-

> "There is some evidence that girls' subject preferences are generally more closely related to their perception of subject easiness".

This is related to Dickson's (1978) conclusion that:-

> "Mathematics because of its somewhat technical and abstract nature, would probably rank as one of the more difficult subjects".

For environmental factors as a whole, it can be concluded that they play a significant and important role in sex differences in achievement in, and attitudes towards, mathematics. The most vital elements of these factors were taken to be:

A. Teachers

B. Parents

C. Curriculum

Their effects result in one of two ways:-

1 - Differing achievement between the sexes - boys generally having the higher achievement.

2 - And/or differing attitudes towards mathematics between the sexes - boys generally having the more positive attitude towards mathe matics.

CHAPTER 3

THE IRAQI EDUCATION SYSTEM

3.1 Introduction

This chapter is devoted to an outline of the Iraqi educational system and to a chart of its recent development. This outline will form the framework within which the investigation is carried out.

Sources for this chapter are: the Government of Iraq published statistics and reports; the United Nations and its associated agencies' statistics and publications, the accumulated experiences and observations of the author while working as a school teacher in Iraq,and information collected during the field investigation of this research.

3.2 The Educational System

The main responsibility for education in Iraq lies with two ministries: Education and Higher Education. The Ministry of Education is responsible for Primary, Intermediate and Secondary Levels, while the Ministry of Higher Education is responsible for higher education, both academic and technical. The system has four levels, namely:-

Primary Education - grades 1 to 6

Intermediate Education - grades 1 to 3

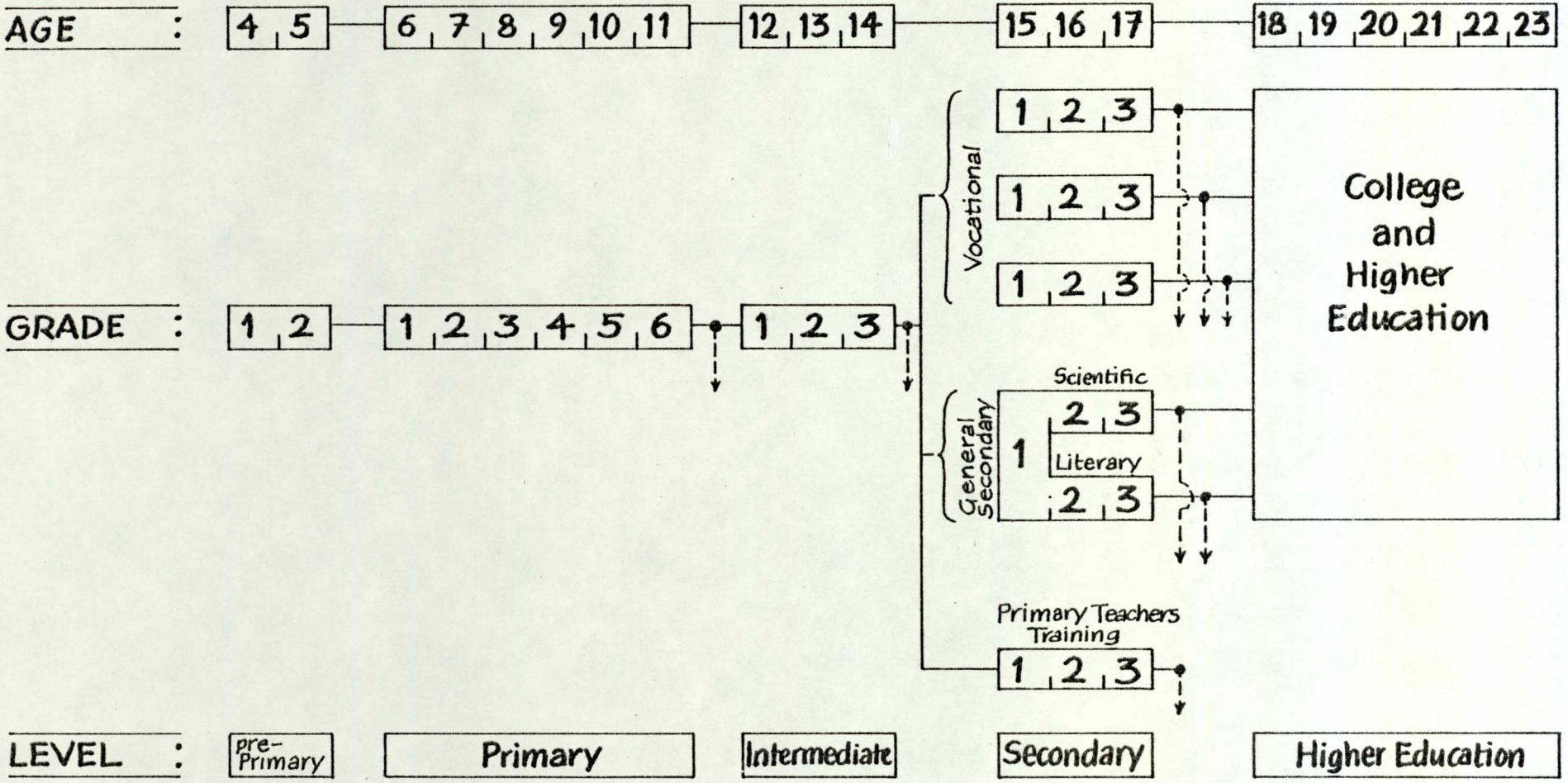
Secondary Education - grades 1 to 3

Higher Education: -Technical Training Institutes - grades 1 and 2

- Universities - grades 1 to 4 or 5 or 6

Figure (3.1) outlines the Iraqi educational system from kindergarten to universities. It shows the educational levels, the expected age of the student at each level and the relationships and flows between the levels.

Apart from the first three years of primary education, where the transfer is automatic, the transfer of students from one grade to another is based on their success in the yearly examination administered by their school (or college). However, the transfer from one level to another (e.g. from intermediate to secondary level) is based on success in a national ministerial examination administered by the ministry of



Key: •----→ Indicates points at which people leave the system.

Source: Iraqi Ministry of Education, Annual Report (1980).

Fig (3.1): The Iraqi Educational System.

education acting as the examination board.

Education at all levels (including higher education) is provided free by the state, no fees are charged, text books and stationary are provided free.

The system is highly centralized, and the curricula are unified for the whole country (the content of the curricula depending on the year, level and stream).

From an examination of Fig (3.1) it becomes clear that the four stages of the educational system are related to one another so as to form an integral whole, with the intermediate level being the most important because pupils in this level make their decisions about what they want to do in future, and hence it constitutes a vital link in their development.

3.2.1 Primary Education

Primary education aims at enabling pupils to read, write and acquire elementary knowledge in science and health education as well as in the social sciences (Iraqi Ministry of Education, 1980). This level starts from the first grade, where children are admitted at the age of six, and ends with the sixth grade. (Lately, there has been an expansion in pre-school education, but, this is voluntary, confined to the main cities and on a relatively small scale, hence it will be ignored from now on). Pupils are promoted to the intermediate level upon their success in the ministerial examination.

Primary education has undergone a noticeable qualitative and quantitative development due to the increasing attention of the government which considers it as one of the fundamental issues closely related to development in all its various fields and sectors. Compulsory primary education was introduced in 1976 and fully enforced during the scholastic year 1978/79. The last ten years have witnessed a great increase in the number of pupils, schools and teachers. Table 3.1 shows these increases.

In 1980, the number of primary schools was 11,324 (1,671 boys' schools, 1,046 girls' schools, and 8,607 mixed schools). The number of children in

these schools was 2.6 million, of whom 1.2 million were female and 1.4 million male. Teachers totalled 92 thousand (42 thousand female, 50 thousand male). Over the same period there was a significant increase in pupils entering the educational system (first grade of primary level). The number increased from 271 thousand in the scholastic year 1970/71 to 427 thousand in the scholastic year 1979/80, i.e. an average annual growth of 6.4% (Iraqi Ministry of Education, 1980)

Table 3.1 Number of Pupils, Teachers and Schools in the Iraqi Primary Education Level for the Period 1968/69 to 1979/80

	Pupils/1,000s'			Teachers/1,000s'			Schools			
Year	Boys	Girls	Total	Male	Female	Total	Boys	Girls	Mix	Total
1968/69	718	298	1017	20	16	46	2673	779	1685	5137
1969/70	736	304	1040	32	16	48	3423	888	866	5176
1970/71	780	318	1098	32	16	48	3615	859	1142	5616
1971/72	851	344	1195	36	18	54	4481	1300	225	6006
1972/73	916	381	1297	36	18	54	4612	1343	314	6269
1973/74	983	424	1408	37	20	57	4848	1501	382	6731
1974/75	1030	493	1528	36	21	57	2339	842	3013	6194
1975/76	1176	588	1765	43	25	68	3198	1079	3417	7664
1976/77	1259	687	1947	41	28	69	2301	912	4942	8156
1977/78	1289	763	2052	44	28	72	2429	1057	4659	8145
1979/80	1403	1212	2615	50	42	92	1671	1046	8607	11324

Sources: Unesco (1982)
Al-habeeb (1981)
Iraqi Ministry of Education (1980)

3.2.2 Intermediate Education

Great attention is paid during the intermediate level to discovering the abilities and tendencies of the pupils and to their guidance, besides a continuous care for the bases of knowledge, skills, tendencies and attitude, with the aim of perfecting

them and following up their applications as an introduction to the next educational level or to pupils' productive life (Iraqi Ministry of Education, 1980). This is a 3-year non-compulsory level at the the end of which successful pupils are awarded a certificate. Admission to this level depends on gaining the primary education certificate. In this level most of the schools are single sex. The curriculum is the same for all pupils. At the end of the intermediate level and after success in the ministerial examination, pupils may enter any one of the following streams (or leave the education system altogether):-

1 - General secondary schools

2 - Vocational secondary schools

3 - Primary teacher schools

4 - Training institutions administered by other ministries such as the Ministries of Oil, Health, Transport and Telecommunications.

There were 90 thousand pupils enrolled in the first intermediate classes in the year 1970/71, whereas this number rose to 285 thousand pupils in 1979/80, i.e. an annual increase of about 24% (Iraqi Ministry of Education, 1980). Most of the teachers of the intermediate level are graduates of universities or higher institutions. The number of pupils in the year 1979/80 was 684 thousand of whom 207 thousand were female and 477 thousand were male. Teachers totalled 14 thousand (6 thousand female, 8 thousand male). The number of schools were 1051 (519 boys' schools, 303 girls' schools, and 229 mixed schools). Table 3.2 shows the increase in the number of pupils over the period 1968/69 to 1979/80.

3.2.3 Secondary Education

Secondary education which is of three years duration constitutes the third level in the system. Pupils who have obtained the intermediate education certificate are allowed to enter secondary education provided that they are not less than 15 years old and are not over 20 years at the date of candidature. There are three main types of

Table 3.2 Number of Pupils, in the Iraqi Intermediate Education Level for Period 1968/69 to 1979/80

	Pupils/1,000s'		
Year	Boys	Girls	Total
1968/69	178	58	236
1969/70	165	65	230
1970/71	160	64	224
1971/72	159	64	223
1972/73	177	70	247
1973/74	196	78	274
1974/75	237	91	328
1975/76	265	104	369
1976/77	291	122	413
1977/78	344	147	491
1979/80	477	207	684

Sources: Iraqi Ministry of Education (1980); Al-habeeb (1981).

schools at the secondary level: General Secondary, Vocational Secondary and Primary teachers training.

A- General Secondary Education

In this level, attention is given towards fostering abilities and tendencies that have been discovered in order to enable students to reach higher standards of knowledge and skills as well as diversifying and widening certain intellectual and practical fields prior to higher education or productive life (Iraqi Ministry of Education, 1980).

The organization of general secondary education is based on courses which are covered in the three year period. Courses in the first year are of a general

nature after which studies branch out into two main streams (literary and scientific) for the final two years. General secondary education receives the pupils of outstanding ability (marks 75 and above in the ministerial intermediate examination), who are assumed to be fit to pursue their studies up to higher education levels. Table 3.3 shows the increase in the number of pupils over the period 1968/69 to 1979/80.

Table 3.3 Number of Students in the Iraqi Secondary Education Level for Period 1968/69 to 1979/80

	Student/1,000s'		
Year	Boys	Girls	Total
1968/69	36	12	48
1969/70	48	20	68
1970/71	55	23	78
1971/72	63	27	90
1972/73	72	32	104
1973/74	78	35	113
1974/75	88	40	128
1975/76	91	38	129
1976/77	101	42	143
1977/78	112	49	161
1979/80	150	61	211

Sources: Iraqi Ministry of Education (1980); Al-habeeb (1981)

B- Vocational Education

Holders of the intermediate school certificate are eligible to join this type of education. It is of three-year duration. Those who successfully pass the final ministerial examination are awarded a certificate equivalent to the general secondary school certificate.

This type of education aims at preparing skilled and well-trained manpower, theoretically and practically qualified within the various fields of

specialization, disseminating vocational education and training to meet the prerequisites of national development as well as keeping in pace with the latest vocational and technical developments (Iraqi Ministry of Education, 1980). Vocational education comprises three streams. These are:-

1 - Industrial stream

2 - Agricultural stream

3 - Commercial stream

Table 3.4 shows the number of students in the vocational stream over the period 1968/69 to 1979/80.

Table 3.4 Number of Students, Teachers and Schools in the Iraqi Vocational Education for the Period 1968/69 to 1979/80

	Students/1,000s'			Teachers			Schools			
Year	Boys	Girls	Total	Male	Female	Total	Boys	Girls	Mix	Total
1968/69	7	3	10	658	344	1002	26	18	-	44
1969/70	7	2	9	704	310	1014	30	18	-	48
1970/71	7	2	9	727	240	967	27	18	-	45
1971/72	7	3	10	872	244	1117	29	20	4	53
1972/73	9	2	11	868	262	1130	39	20	4	63
1973/74	11	4	15	954	301	1255	38	20	7	65
1974/75	15	5	20	1115	393	1508	20	20	21	71
1975/76	18	5	23	1339	272	1611	29	22	29	80
1976/77	22	5	27	1608	298	1906	33	9	40	82
1977/78	27	7	34	1921	412	2333	39	9	44	92
1979/80	38	15	53	3117	811	3928	33	27	66	126

Source: Iraqi Ministry of Education (1980).

1. Industrial Stream

This aims at training skilled industrial workers. There are various departments in these schools including fitting and turning, carpentry , massonry and weaving.

In the scholastic year 1979/80 the total number of students was 30 thousand of whom 2 thousand were female and 28 were male. The number of teachers being 3,928 of whom 811 were female and 3,117 were male and the total number of schools was 50 (9 male schools, and 41 mixed schools).

2. Agricultural Stream

This aims at training skilled farm workers and specialists in the field of rural guidance. In the scholastic year 1979/80, the total number of students in the agricultural schools amounted to 8 thousand (1 thousand female, 7 thousand male), the total number of teachers was 1,006 (98 female, 908 male) and the total number of schools was 28 (10 male and 18 mixed schools).

3. Commercial Stream

This prepares students for secretarial and office work and trains them in accounting and typewriting, book-keeping and shorthand.

In the scholastic year 1979/80 the total number of students in commercial schools amounted to 14 thousand (11 thousand male, 3 thousand female), the total number of teachers being 691 (469 female, 222 male). The total number of schools was 98 (14 male schools, 27 female schools, and 7 mixed schools).

C. Primary Teacher Training Institutes

These offer three-year course of study after the completion of intermediate school or its equivalent. The aim of these institutes is to train efficient primary teachers. All students take the same subjects in the first grade then divide into two streams for the final two years. The two streams are:-

1 - Pre-school education

2 - Primary education

During the scholastic year 1979/80 the number of students was 18 thousand (13 thousand female, 5 thousand male), the number of teachers was 772 (514 female and 258 male) and the total number of schools was 35 (16 male schools, 19 female schools). Table 3.5 shows the increase in number of students, teachers and institutes over the period 1970/71 to 1979/80.

Table 3.5 Iraqi Teacher Training Schools and Institutes, Number of Students, Teachers and Institutes for the Period 1970/71 to 1979/80

Year	Students/1,000s'	Teachers	Institutes
1970/71	-	-	-
1971/72	-	-	-
1972/73	7	120	5
1973/74	7	185	5
1974/75	8	306	11
1975/76	16	646	37
1976/77	21	837	43
1977/78	23	907	45
1978/79	20	939	46
1979/80	22	993	50

Source: Iraqi Ministry of Education (1980)

3.2.4 Higher Education

Special attention has been given to technical institutes and colleges as being the essential assets for economic and social development. They provide qualified technical cadres in the various specializations at all professional levels to participate in the implementation of developmental projects (Iraqi Ministry of Education, 1980). These institues and colleges admit graduates of secondary schools, some accepting graduates of the scientific stream, others accepting graduates of the literary stream, while the rest accept graduates of vocational schools.

In Iraq, there are seven universities as well as the Foundation of Technical Institutes which consists of 19 technical institutes.

The Iraqi universities have entrered the field of postgraduate studies. The numbers of students enrolled in higher studies (PhD, MA and Higher Diploma) during the academic year (1979/80) was 2,674 students (438 female and 2,236 male). Table 3.6 shows the increase in the number of university and institute graduates over the

period 1970/71 to 1979/80.

Table 3.6 Iraqi Higher Education: Number of Students Graduating at Universities, Colleges and Technical Institutes for Period 1970/71 to 1979/80

	Students/1,000s'		
Year	Male	Female	Total
1970/71	33	9	42
1971/72	37	10	47
1972/73	37	11	48
1973/74	42	15	57
1974/75	51	19	70
1975/76	53	22	75
1976/77	56	24	80
1977/78	58	26	84
1978/79	61	27	88
1979/80	68	30	98

Source: Iraqi Ministry of Education (1980)

3.3 Mathematics in the Intermediate and General Secondary Schools

The Ministry of Education has been devoting considerable attention to the modernization of mathematics syllabi and to methods of teaching at the general secondary level, and the intermediate level. Among the topics introduced into the general secondary education mathematics syllabi are those which appeared at the end of the 19th century and the beginning of the 20th century in a wide range of branches of mathematical knowledge. El-Mofty et al. (1975) and Said (1973) indicated that the theory of sets, operations and transformations in geometry have been introduced into the syllabi. New trends in treatment such as the language of sets and mathematical

structures under which the different branches of mathematics are unified have also been included, whilst a considerable degree of attention has also been paid to the practical applications of mathematical manipulation skills and mathematical concepts.This has demanded new text books so as to help students and teachers cope with modified syllabi.

Mathematics comes after Arabic - the mother tongue - and the first foreign language - English - in status amongst the subjects taught in the intermediate schools, where it is usually allotted 5 periods per week.

The modified syllabi for intermediate level are given in table 3.7, which shows the plan of study for the intermediate schools issued by the Iraqi Ministry of Education, (1980).

Table 3.7 The Plan of Study for Intermediate Level

Subject	No. of periods per week		
	1st Year	2nd Year	3rd Year
Religious Ed.	2	1	1
Arabic	6	6	6
English	6	5	5
History	2	2	2
Geography	2	2	2
Cummunity & National Ed.	1	1	1
Biology	3	3	3
Physics	-	2	2
Chemistry	-	2	2
Principles of Math.	5	-	-
Algebra	-	2	2
Geometry	-	3	3
Art Ed.	2	1	1
Sports	2	2	2
Total	31	32	32

CHAPTER 4

RESEARCH DESIGN AND DEVELOPMENT

4.1 The Research Design

4.1.1 Statement of the Problem

The main direction of this research is to investigate sex differences in attitudes towards mathematics among third year intermediate school pupils in Iraq approximately 14 years of age, since it is at this age that pupils must decide whether to follow vocational or general (scientific or literary) streams (see chapter 3). Hence, the attitude of pupils at this age towards science subjects in general, and mathematics in particular, is a crucial factor in deciding the future scientific orientation (or otherwise) of the pupils.

The research will concentrate on the impact of what will be called environmental factors on the pupils attitude towards mathematics, based on the belief (see chapter 2) that these factors play the major part in attitude formation.

The environmental factors will be divided into three groups:-

1 - Teacher influence

2 - Parental influence

3 - Curriculum influence.

4.1.2 Aims of the Study

The aims of this study may be simply stated. They were:-

1 - To investigate sex differences in attitude towards mathematics among third year intermediate school pupils in Iraq.

2 - To investigate the influence of the teachers on pupils attitudes; the effect of their encouragement, relationship, ability and expectation.

3 - To investigate the influence of the parents on their sons and daughters' attitudes; their encouragement, expectation and attitude towards mathematics.

4 - To investigate the influence of the curriculum on pupils attitudes; its difficulty, relevance, length and usefulness.

In practice these aims had to be refined in order to provide a set of

propositions which could be tested in a reasonable amount of time by the methods available to the researcher.

The formulation and testing of these propositions in this research should not be taken as representing the full achievement of the above aims, but merely a contribution to the understanding of the nature and influence of environmental factors within the context of Iraqi intermediate schools.

4.1.3 The Propositions

This investigation may be regarded as an attempt to test a small number of related and interconnected propositions concerning sex differences in attitude towards mathematics, and the factors which influence these differences.

Proposition 1

As mentioned earlier (chapter 2), most studies support the proposition that there are sex differences in attitudes towards mathematics, especially among secondary school pupils. We may therefore hypothesize for our particular investigation, that:-

"In Iraq, for pupils in the third year of intermediate school (14 years old), there are sex differences in attitudes towards mathematics".

Proposition 2

Teachers are the most important educational influence on students' learning of mathematics. From kindergarten to high school, pupils spend thousands of hours in direct contact with teachers. While other educational agents may have influence on educational decisions, it is the daily contact with teachers that is the main influence of the formal educational institution. Part of the teacher's influence lies in the pupils' development of sex-role standards. These sex-role standards include definitions of acceptable achievement in the various subject areas. It is believed that this influence by teachers is exerted through their differential treatment of the sexes as well as through their expectation of sex-related differences in achievement (Fennema, 1978).

Also many studies, reported in chapter 2, mentioned that one of the main factors influencing sex differences as far as they affect choices of career subjects and attitude towards mathematics is teacher influence and teachers' ability to teach and encourage. Therefore, we may hypothesize for our particular investigation, that:-

"In Iraq, for pupils in the third year of intermediate school, differences in attitudes between the sexes towards mathematics are influenced by their teachers".

Proposition 3

Many studies have suggested that parental influences strongly affect students choice of course, achievement in mathematics and career aspirations through role modelling, direct encouragement and expression of positive attitudes toward mathematics (e.g. Armstrong, 1980).

Parental influence is likely to play a prominent part in a child's acquisition of various attitudes. It is generally acknowledged (chapter 2) that a child's attitude toward mathematics and his or her progress at school are to some extent dependent upon parental attitude and aspirations. We may therefore hypothesize for our particular investigations that:-

"In Iraq, for pupils in the third year of intermediate school, differences in attitude towards mathematics between the sexes are affected by parental influence".

Proposition 4

Girls and boys frequently have different learning styles and different interests, but mathematics curricula do not take this into account. Girls also tend to be interested in the social implications of subjects and favour those subjects dealing with people more than things and objects. The syllabus of mathematics is more theoretical and abstract and full of impersonal aspects and tends to neglect the practical implications, although pupils are interested in these. It has been suggested that it is possible to teach the same material with more relevant and interesting examples. Armstrong (1980) advocated that:-

"Methods and programmes which will increase students' liking of mathematics, need to be developed and evaluated".

Also, mathematics courses and subjects tend to be rather difficult compared with other courses and subjects, as mentioned in chapter 2. We may therefore hypothesize, for our particular investigation, that:-

"In Iraq, for pupils in the third year intermediate school, differences in attitude towards mathematics between the sexes are influenced by the content of the mathematics curriculum".

4.1.4 The Research Method

Since the aim of the research is to collect data about existing and ongoing attitudes and their influencing factors and not to study changes in the pattern of behaviour and attitude, then the most suitable method for investigation will be found within the "systematic survey" category. This category includes the methods of questionnaires, interviews and observation.

The questionnaire method was adopted because of the following factors:-

1 - The research has to be conducted in a class setting in various intermediate schools, under the sponsorship of the Iraqi Ministry of Education to ensure access and cooperation.

2 - The aim is to investigate the highest number of pupils within the constraints of time and, critically, money. (The research is an academic project with no external funding).

3 - The respondents are teenagers and it was anticipated that their answers would be very biased if interviewing or observation methods were used, with high tendencies to impress and show off; this may be attributed to the scarcity of research conducted in Iraqi intermediate schools and to cultural factors influencing the

behaviour, especially of boys, in the presence of female researchers. Anonymity of the pupils is vital in this study to attempt to ensure that they reflect their true opinions and attitudes.

4 - To ensure that the pupils are subjected to the same standard probing, a format employing standard wording has to be adopted that will facilitate comparisons between the answers of pupils. The need for standardized questioning in this study is more important than the need for flexibility because of the large sample involved and the characteristics of the pupils and the study.

The above factors seemed to support the proposition that the most suitable method for this research was the use of standard questionnaires.

4.1.5 Questionnaire Design

This section is devoted to an outline of the design of the relevant questionnaires. A separate questionnaire was designed to investigate each proposition (1 to 4).

Several methods or techniques of measuring attitude towards mathematics and the influence of teachers, curriculum, and parents are available for use in an investigation such as this. Of these the questionnaires have often been used in research in education (Oppenheim 1966, Bailey 1978).

The items that constitute the questionnaires were compiled according to the following basis: the guidelines suggested by such authors as Oppenheim (1966) and Bailey (1978) to ensure effective and unbiased questionnaires; the composite variables and factors outlined in the literature review; questionnaires used by other researchers to investigate similar propositions (e.g. Husen 1967; Badary, 1978; Gopal Rao, 1973; Frank et al, (1983)); and, the experience and knowledge of the author concerning the Iraqi educational enviornment. The first version of the questionnaires were deliberately made large and containing the largest possible number of items and questions. These versions were then filtered and reduced according to information

gained from a pilot study, to produce the final versions. The final versions of the questionnaires are reproduced in the Appendices A-E, and they are the versions that were used to test the Iraqi sample. The details of the design of the questionnaires will now be outlined in turn.

Questionnaire A

This was designed to cover the attitude of pupils towards mathematics (proposition 1). An open-ended format was adopted. The questions were chosen to determine the relative place of mathematics in comparison to other subjects. The pupils were asked to list the subjects according to the following basis:-

1 - Like and dislike (Items : 1 & 2);

2 - Easiness and difficulty (Items: 3 & 4);

3 - Most useful and least useful (Items: 5 & 6);

4 - Most important and least important (Items: 7 & 8).

The final version of the questionnaire is reproduced in Appendix A.

Questionnaires B and C

These were designed to cover the influences of teachers (proposition 2). Questionnaire B was answered by pupils in order to investigate the influence of teachers on their attitude towards mathematics. This influence was measured by a Likert-type scale. The principal elements covered by the questionnaire were:-

1 - Relationship between pupils and teachers, (Items: 1, 4, 7, 10)

2 - Encouragement of teacher as perceived by pupils, (Items: 2, 5, 8, 11);

3 - Ability of teachers as envisaged by pupils (Items: 3, 6, 9, 12).

The final version of the questionnaire is reporduced in Appendix B.

Questionnaire C was answered by teachers and investigates their expectations. These were measured by "Yes" or "No" scales. The principal elements covered by the questionnaire were:-

1 - Expectations of teachers as to the capability of their pupils in mathematics (Item:1);

2 - Differences in teachers' expectations between boys and girls (Items: 2-6).

The final questionnaire is reproduced in Appendix C.

Questionnaire D

This was designed to cover the influence of parents (proposition 3). It contains two sections; the first was to obtain the principal facts about the education and occupation of the pupils' parents; the second was to measure the influence of parents by a "Yes" or "No" scale. The principal elements covered by this questionnaire were:-

1 - Attitudes of parents towards mathematics, (Items: 1, 4, 7, 10);

2 - Encouragement to pupils by parents (Items: 2, 5, 8, 11);

3 - Expectations of parents for their sons and daughters (Items: 3, 6, 9, 12).

The final version of the questionnaire is reproduced in Appendix D.

Questionnaire E

This was designed to cover the influence of the curriculum content (proposition 4). The influence was measured by a Likert-type scale. The principal elements covered by the questionnaire were:-

1 - Usefulness of the curriculum as perceived by pupils (Items: 1, 5, 13, 17, 18);

2 - Difficulties of comprehending the curriculum as perceived by pupils (Items: 3, 7, 8, 14, 15);

3 - Relevance of the curriculum as percieved by pupils (Items: 2, 6, 9, 10, 19);

4 - Length of the curriculum as perceived by pupils (Items: 4, 11, 12, 16, 20).

The final version of the questionnaire is reproduced in Appendix E.

Table 4.1 summarizes the research design.

Table 4.1 Summary of Research Design

Propositions	Area	Questionnaires	Respondents	Answer Format
Proposition 1	Attitude	Appendix A	pupils	open-ended
Proposition 2	Influence of teacher	Appendix B Appendix C	Pupils Teachers	Likert-type scale Yes or No Scale
Proposition 3	Influence of parents	Appendix D	Pupils	Yes or No Scale
Proposition 4	Influence of curriculum	Appendix E	Pupils	Likert-type scale

4.2 The Studies

4.2.1 The Pilot Study

As a first stage in the development of the pupil questionnaires, a pilot study was undertaken with a small group of Iraqi pupils in the UK: in the Iraqi school in London. The subjects were 12 pupils in the third year of the intermediate level aged 14 - 15 composed of 4 boys and 8 girls. The aim of the pilot study was mainly to find out how pupils would respond to the types of questions used, and to provide some indication of the range of answers that might be obtained in the main study. It was planned to use the results from the pilot study as a guide to the construction and refinement of the final pupil questionnaires. The responses of the pupils were analysed by hand.

The pilot study provided an opportunity to weigh the relevancy of each question and the degree of its comprehensibility by the pupils. Using the answers, as well as questions raised and discussions conducted during the administration of the questionnaires, the original questionnaires were reduced in size and some of the questions were rewritten. Appendices A, B, D and E show the final versions of the questionnaires that were administered to pupils in the main study in Iraq.

4.2.2 The Main Study

The main study was carried out in Baghdad, Iraq over a two month period - December 1983/January 1984-under the auspices, and with the cooperation, of the Iraqi Ministry of Education which kindly assisted in the choice of schools, in providing unlimited access to the chosen ones and in ensuring the full cooperation of the school's administrators in the administration of the questionnaires to the pupils.

The study was based upon a sample of 436 pupils: 209 boys and 227 girls, in twelve third year classes in six interemediate schools (all single sex). Ages of the pupils ranged from 14 - 15 years. These schools were located in three different suburbs in Baghdad, chosen to reflect the main socioeconomic classes prevalent in modern urban Iraq. These classes are: upper-middle class; lower-middle class and working class.

The Ministry of Education have three general directorates (G.D.s) in Baghdad, namely;

1 - G.D. of Education in Baghdad Al-Karkh,

2 - G.D. of Education in Baghdad Al-Rusafa

3 - G.D. of Education in Baghdad Sadam City.

Al-Karkh and Al-Rusafa G.D's contain suburbs of varying social and economic characteristics. However, the Sadam City G.D. contains mainly working class suburbs. Two schools (one boys, one girls) were chosen in Baghdad Al-Karkh; these schools were in the Al-Mansoor suburb, with an upper-middle class population. Two schools (one boys, one girls) were chosen in Baghdad Al-Rusafa; these schools were in the Al-Qanat suburb, with a lower-middle class population. Two schools (one boys, one girls) were chosen in Baghdad Sadam City; these schools were in the Al-Thawra suburb, with a working class population. Two third-year classes in each school were chosen. The number of pupils in each class varied between 29 and 37. The pupils in the chosen classrooms were tested, in a class setting, with questionnaires A, B, D, and E. A standard briefing about the purpose of the study, its relevance and the way to answer the questionnaires was given to each class before the

distribution of the questionnaires (a copy of each questionnaire was given to each pupil).

A total of twenty mathematics teachers from the chosen schools were tested by questionnaire C. Table 4.2 shows the number of pupils and teachers tested in each of the chosen schools and, thus, shows the logistics of the main study.

Table 4.2 Details of the Main Study in Iraq.

GD's of Ed.	Social Characteristic of the suburb	Schools	Sex of Schools	No of Classes	No of Pupils	No of Teachers
Al-Karkh	Upper-middle class	Al-Mansoor	Boys	2	77	4
	Upper-middle class	Al-jamea'	Girls	2	76	3
Al-Rusafa	Lower-middle class	Al-Qanat	Boys	2	68	3
	Lower-middle class	Al-Qanat	Girls	2	77	4
Sadam City	Working class	Al-Kadiheen	Boys	2	64	3
	Working Class	Al-Amane	Girls	2	74	3
TOTAL:				12	436	20

4.3 The Analysis

4.3.1 Coding and Scoring

Various methods and techniques for scaling and scoring the respondents' replies were adopted. This section outlines the techniques adopted for each questionnaire in turn.

Questionnaire A

In this questionnaire, the pupils were free to list whichever subjects they wished to in each category. Mathematics was not especially mentioned nor was any other subject. While the analysis of the replies from the pupils might enable us to find out the relative popularity or unpopularity of all subjects of the school curriculum, our main interest was to look at mathematics in relation to other subjects.

To facilitate the overall ranking of each subject, it was decided to give the following weights to the responses.

3 marks if the subject was mentioned, in any of the enjoyment, easiest, most useful and most important categories of the questionniare.

2 marks if the subject was not mentioned.

1 mark if the subject was mentioned in any of the less enjoyment, difficult, least useful and least important categories of the questionnaire.

Questionnaire B

This questionnaire was prepared according to the method recommended by Likert (1932). There were twelve items in the questionnaire, of which eight were favourable and the other four unfavourable. The scoring method was to allot 5, 4, 3, 2 or 1 as a mark if the response to the favourable item was 'strongly agree', 'agree', 'uncertain', 'disagree' or 'strongly disagree' respectively. The scoring was reversed for the unfavourable items.

Questionnaire C

This short questionnaire was answered by the teachers. There were 6 items in the questionnaire, two of which were favourable and four unfavourable the scoring was to allot '1' or '0' as a mark if the response to the favourable item was 'Yes' or 'No' respectively. The scoring was reversed for the unfavourable items.

Questionnaire D

Responses concerning the occupations of parents were categorized according to the classification of occupation suggested by Hall-Jones, quoted in Oppenheim (1966) (the classification is reproduced in Appendix F).

Responses concerning the education level of parents were classified according to the categories adopted by the Iraqi statistical authorities (Ministry of planning, 1978); they are "illiterate", "read and write", "primary", "intermediate", "secondary", "diplomas", "university", and "others".

The items forming the rest of the questionnaire adopted the 'Yes' or 'No'

format. Four of the twelve items in the questionnaire, were unfavourable and the other eight were favourable. The scoring was to allot '1' or '0' as a mark if the response to the favourable item was 'Yes' or 'No' respectively. The scoring was reversed for the unfavourable items.

Questionnaire E

This questionnaire was prepared according to the method recommended by Likert (1932). There were twenty items in the questionnaire, of which nine were favourable and the other eleven unfavourable. The scoring was to allot 5, 4, 3, 2, or 1 as a mark if the response to the favourable items was 'strongly agree', 'agree', 'uncertain', 'disagree', or 'strongly disagree' respectively. The scoring was reversed for the unfavourable items.

4.3.2 Analysis Procedures

In all phases of the investigation it was necessary to analyse considerable amounts of data. Of necessity this data analyis involved the use of a number of statistical techniques. In order to use the appropriate statistical procedures in the data analysis and scale development, it was decided to make use of a readily available system of computer programmes at all stages of the investigation. The system adopted was the Statistical Package for the Social Sciences (SPSS), developed by Nie et al. (1975). This package is widely available. In many places in the following chapters statistical significance is indicated by making use of the following convention: * or ** corresponding to significance at the 0.05, and 0.01 levels of probability respectively. Non-significant results are indicated by the abbreviation 'ns'. The following is a brief summary of the tests and analyses carried on each questionnaire, in turn.

Questionnaire A

Analysis of variance was employed to study the significance of sex differences in attitudes towards mathematics, in order to test proposition 1. Tabulation of the subjects ranking was done by hand.

Questionnaire B

Measures of reliability tests were used to ascertain the effectiveness of the questionnaire as a tool. Factor analyses were carried out to ascertain the dimensionality of the teacher's influence. Analysis of variance was used to obtain an insight into the significance of sex differences between the scores (in order to test proposition 2).

Questionnaire C

Teachers' responses were analysed in a descriptive manner and the salient points were highlighted.

Questionnaire D

Measures of reliability were used to ascertain the effectiveness of the questionnaire as a tool. Factor analyses were carried out to ascertain the dimensionality of the parents' influence. The method of crosstabulation was used to study the significance of the influence of parents on sex differences in attitudes. The results were used to test proposition 3.

Questionnaire E

Measures of reliability were used to ascertain the effectiveness of the questionnaire as a tool. Factor analyses were carried out to ascertain the dimensionality of the curriculum influence. Analysis of variance was used to obtain an insight into the significance of sex differences between the scores (in order to test proposition 4).

CHAPTER 5

VALIDATION OF THE RESEARCH INSTRUMENTS

5.1 Reliability of the Questionnaires

Reliability of the test measures is a key aspect in judging the quality of a measurement instrument. Reliability may be defined as (Anastasi, 1976):-

> "The consistency of scores obtained by the same persons when re-examined with different sets of equivalent items, or under other variable examining conditions".

The reliability of a test is usually expressed either by a reliability coefficient or by the standard error of measurement. The most well known and frequently used methods of estimating reliability are: parallel forms, test re-test, alternative forms, split-halves, and internal consistency.

The assessment of reliability was confined to questionnaires B (measuring teacher's influence), D (measuring mother's and father's influence) and E (measuring curriculum influence) only; questionnaires A (measuring attitudes towards mathematics) and C (measuring teacher's expectation) were excluded from reliability testing because the former is an open-ended questionnaire and the latter involves very small number of respondents. Initially, questionnaires B, D and E were considered to yield just four scores: teacher's influence, father's influence, mother's influence and curriculum influence. To determine the reliability of the four scores, the internal consistency method was employed. This method, for our purpose, should be quite adequate for providing a reasonable estimate of the reliability of the questionnaires. This is because, the determination of the internal consistency of a test is based upon a single test administration and provides a unique estimate of reliability for it (Carmins and Zeller, 1979). By far the most popular of the reliability estimates is given by Cronbach's alpha (Cronbach, 1951). Nunnaly (1978) considers coefficient alpha as the fundamental formula for obtaining the reliability which is based on internal consistency. In addition to its popularity, coefficient alpha was chosen because it can provide a satisfactory measure of reliability in most situations. Indeed, Nunnally recommends that coefficient alpha should always be obtained prior to

estimation of any other types of reliability coefficient. Coefficient alpha was obtained by using the following formula:-

$$\alpha = \frac{Nv}{1 + v\,(N-1)}$$

where:- α = Coefficient alpha

N = Number of items

v = Mean interitem correlation

The values of coefficient alpha, for all the teachers, parents and curriculum questionnaires for the whole sample of third year intermediate school pupils for both sexes combined (n=436) and for each sex separately (boys=209, girls = 227) were computed using the above formula. See Tables 5.1 and 5.2 respectively.

Table 5.1 Coefficient Alphas of the Teacher, Father, Mother and Curriculum Questionnaires for both Sexes (n = 436)

Possible Scales	Coefficient Alpha
Teacher's influence	.83**
Father's influence	.50*
Mother's influence	.57*
Curriculum influence	.74**

** Significant at the 1% level

* Significant at the 5% level

From the two tables it can be noted that the alpha coefficients for all tests are significant beyond the 1 per cent and 5 per cent levels. The high value of the alpha coefficient for the scale measuring teacher's influence (0.83) indicates a high level of

Table 5.2 Coefficient Alphas of the Teacher, Father, Mother and Curriculum Questionnaires for Single Sex (boys=207, girls=227)

Possible Scales	Coefficient Alpha Boys = 209	Coefficent Alpha Girls = 227
Teacher's influence	.76**	.87**
Father's influence	.55*	.51*
Mother's influence	.54*	.61**
Curriculum influence	.71**	.70**

** Significant at the 1% level
* Significant at the 5% level

internal consistency and the absence of sub-scales within it; hence the questionnaire may be treated as one scale measuring the construct of teacher's influence on pupils' attitudes. However, the lower values of the alpha coefficients for the other scales, especially for the ones measuring Father's and Mother's influence, suggest the possibility of a lack of internal consistency due to the existence of sub-scales. This possibility was examined for all four scales (the teacher's influence scale being included for the sake of confirmation) using factor analysis.

5.2 Factor Analysis

5.2.1 Teacher's Influence (questionnaire B)

In this questionnaire the objective was to measure the influence of mathematics teachers on the attitudes of pupils towards mathematics. In the original construction of this questionnaire, three sets of items had been included. These were: encouragement, relationship, and ability of teacher. The data obtained from questionnaire B were subjected to factor analysis. As with all other statistical analysis

in this study, use was made of the Statistical Package for the Social Sciences (SPSS) developed by Nie et al. (1975). In this case it was the Sub-program "Factor" that was used.

The main purpose of factor analysis was to measure the extent of the unidimensionality (or otherwise) of the proposed scales. The unidimensionality of a scale has been defined by Oppenheim (1966) as:-

> "Unidimensionality or homogeneity means that scale should be about one thing at a time, as purely as possible".

Brown (1970) also stated that:-

> "Unidimensionality means that the test measures only one variable (trait) rather than some combination of variables".

In order to test the unidimensionality of the scale, the first step was to examine the tables as to the number of factors which can be extracted. Child (1970) indicated that:-

> "A technique in considerable use at present is Kaisers' Criterion suggested by Guttman and adapted by Kaiser. The rule is simple to apply. Only the factors having latent roots greater than one are considered as common factors".

The factors extracted from questionnaire B are set out in Table 5.3. Factors having eigenvalues less than one are omitted from the table.

Table 5.3 Relevant Factors of Questionnaire B, Teacher's Influence

Factor	Eigen value	Percentage of variance
1	4.32	36.0
2	1.17	9.8
3	1.12	9.4

Table 5.3 shows that the large proportion of the variance accounted for by factor 1 (about four times the amount of factor 2) strengthens the view, suggested by the high value of the alpha coefficient (0.83 - see 5.1 above) that the scale is unidimensional. However, the factor analysis was continued by using Varimax and Oblique rotation techniques to form solutions with 2, 3 and 4 factors. Table 5.4 shows the results of a Varimax rotation with three factors.

Table 5.4 Varimax Rotated Factors Matrix of the Teacher's Influence

Items	Factor 1	Factor 2	Factor 3
TEAØ1	80	19	12
TEAØ2	77	12	21
TEAØ3	76	20	27
TEAØ4	45	58	-16
TEAØ5	38	64	10
TEAØ6	08	72	21
TEAØ7	25	03	59
TEAØ8	-04	23	70
TEAØ9	43	17	46
TEA10	22	12	60
TEA11	01	69	25
TEA12	45	05	43

Decimal points omitted; loadings in excess of 0.40 underlined.

Table 5.4 shows that all the items of the three original sets (see section 4.1.5): relationship (items 1, 4, 7, 10), encouragement (items 2, 5, 8, 11), and ability of teacher (items 3, 6, 9, 12) ,display mixed factor loadings on the three factors. For instance items that have factor loadings of 0.4 or above on Factor 1 belong to the

three original sets; items 1, 4, and 9 belong to the teacher's relationship set; item 2 belongs to the teacher's encouragement set and items 3 and 12 belong to the teacher's ability set. Items 4, 9 and 12 have notable loadings on more than one factor. Various oblique rotations were tried but did not seem to produce clear, readily interpretable factors. Hence, for the teacher influence questionnaire it was decided to treat all the three original sets of items as one scale, which was called TEATOT.

5.2.2 Parents' Influence (questionnaire D)

In this questionnaire the objective was to measure the influence of parents on their sons' and daughters' attitudes towards mathematics. In the original construction of this questionnaire, three sets of items had been included. These were: encouragement, expectation, and attitude of parents towards mathematics. The fairly low alpha coefficient (0.50-see 5.1 above) suggests that it may not be correct to combine these sets into a single scale. The data obtained from questionnaire D were subjected to factor analysis, which suggested that there may be five relevant factors i.e. with eigenvalues greater than one (Table 5.5).

Table 5.5 Relevant Factors of Qustionnaire D, Father's Influence

Factor	Eigenvalue	Percentage of Variance
1	2.27	19.0
2	1.31	11.0
3	1.24	10.4
4	1.11	9.3
5	1.04	8.7

The factor analysis was extended by the using Varimax and Oblique rotation techniques to seek solutions with 2, 3, 4 and 5 factors. Initially, the five factor Varimax rotation was studied. The details are presented in Table 5.6.

Table 5.6 Varimax Rotated Factor Matrix of the Father's Influence

Items	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
FATØ1	67	08	13	-07	-16
FATØ2	64	-24	-04	22	28
FATØ3	19	02	-80	02	-07
FATØ4	-02	11	-01	58	02
FATØ5	59	40	19	11	05
FATØ6	10	12	-03	-01	-67
FATØ7	08	56	-22	46	-26
FATØ8	16	22	-13	-04	73
FATØ9	-19	06	54	52	18
FAT10	27	-17	11	70	-09
FAT11	-00	76	20	-03	12
FAT12	19	44	56	-04	-12

Decimal points omitted; loadings in excess of 0.40 underlined.

Table 5.6 shows that all the items of the three original sets (see section 4.1.5): encouragement (items 2, 5, 8, 11), attitude of fathers (items 1, 4, 7, 10) and fathers' expectation (items 3, 6, 9, 12), display mixed factor loadings on the five relevant factors. For instance, items that have factor loadings of 0.4 or above on Factor 1 belong to two of the three sets; items 1 belongs to father's attitude and items 2 and 5 belong to father's encouragement yet at the same time item 5 had significant

factor loading on Factor 2 also. It also can be noted that items 6 and 11 did not have significant factor loading on any factors. Item 9 had significant factor loading on Factor 3 and 4 and item 12 had significant factor loading on Factors 2 and 3.

Hence, the diversity of the items loadings on the above five factors, suggest that the items cannot be aggregated either into the original three sets, nor into new sub-scales. Oblique rotations were tried with a range of number of factors. None produced a clear, interpretable pattern - see for example Table 5.7 for the Oblique three factor solution.

Table 5.7 Factor Analysis of Father's Influence, Oblique 3 Factor Solution

Items	Factor 1	Factor 2	Factor 3
FATØ1	12	-82	07
FATØ2	-05	-15	28
FATØ3	41	-03	10
FATØ4	06	00	20
FATØ5	40	-16	17
FATØ6	09	-02	-00
FATØ7	23	05	17
FATØ8	03	-02	-00
FATØ9	24	14	27
FAT10	-08	04	75
FAT11	53	04	-12
FAT12	64	00	-03

Decimal points omitted; loadings in excess of 0.40 underlined.

For the mother's influence, the factor analysis produced three factors with eigenvalues greater than one (Table 5.8).

Table 5.9 shows the structure of the influence as determined by the Varimax rotation method.

Table 5.8 Relevant Factors of Questionnaire D, Mother's Influence

Factor	Eigenvalue	percentage of variance
1	2.33	19.5
2	1.69	19.2
3	1.23	10.3

Table 5.9 Varimax Rotated Factors Matrix of the Mother's Influence

	Factor 1	Factor 2	Factor 3
MOTØ1	44	22	-10
MOTØ2	21	46	-30
MOTØ3	56	25	03
MOTØ4	-17	70	-05
MOTØ5	74	08	-06
MOTØ6	-15	01	68
MOTØ7	27	37	38
MOTØ8	25	00	-67
MOTØ9	29	51	00
MOT10	-01	68	27
MOT11	61	-31	-09
MOT12	61	-04	18

Decimal points omitted; loadings in excess of 0.40 underlined.

Table 5.9 shows that all the items of the three original sets, (see section 4.1.5). encouragement (items 2, 5, 8, 11), attitude of mother (items 1, 4, 7, 10) and expectation (items 3, 6, 9, 12) ,display mixed factor loading on the three factors. For

instance items that have factor loading of 0.4 or above on factor 1 belong to the three sets; item 1 belongs to the mother's attitude, items 3 and 12 belong to the mother's expectation and items 5 and 11 belong to the mother's encouragement. Also items 7 and 8 did not have significant factor loading on any of the three factors. Oblique rotation, even when increasing the number of factors, did not produce a solution with sub-scales containing a sensible number of items - see Table 5.10 for example.

Table 5.10 Factor Analysis of Mother's Influence, Oblique 4 Factor Solution

Items	Factor 1	Factor 2	Factor 3	Factor 4
MOTØ1	22	07	14	15
MOTØ2	15	27	17	01
MOTØ3	70	18	-08	-61
MOTØ4	-06	56	03	00
MOTØ5	-44	-09	29	29
MOTØ6	09	-01	-27	19
MOTØ7	-08	14	-04	64
MOTØ8	-02	-01	58	03
MOTØ9	21	31	04	10
MOT10	01	52	-16	18
MOT11	33	-31	16	11
MOT12	47	-01	-06	08

Decimal points omitted; loadings on excess of 0.40 underlined.

In addition, there were important differences between the solutions from for father and mother (compare Tables 5.7 and 5.10) so that the same sub-scales could not have been used for both parents, thus making comparisons between parents

difficult. After careful consideration, it was decided not to scale the parents' influence questionnaire, but instead to retain all items separately.

5.2.3: Curriculum Influence (questionnaire E)

In this questionnaire the objective was to measure the influence of the mathematics curriculum on the pupils. In the original construction of this questionnaire, four sets of items had been included. These were: usefulness, relevance, length and difficulty. Results obtained from the questionnaire were subjected to factor analysis. Factor analysis suggested that there may be five factors in the structure of the questionnaire i.e. with eigenvalues greater than one (Table 5.11).

Table 5.11 Relevant Factors of Questionnaire E , Curriculum Influence.

Factor	Eigenvalue	Percentage of Variance
1	3.70	18.5
2	2.01	10.1
3	1.80	9.0
4	1.28	6.4
5	1.06	5.3

The factor analysis was extended by using Varimax and Oblique rotation techniques to seek solutions with 2, 3, 4, 5 and 6 factors. In the five and six factor solutions, the last two factors had significant loadings (0.40 or above) on three or fewer of the items. However, the first four factors, in the same solutions, showed similar groupings of loadings whatever the method used (varimax or oblique rotation).

The clearest of the solutions was the Oblique four factor solution. Table 5.12 indicates that by underlining all the loadings on the Oblique four factor solution that were equal to or in excess of 0.40. In addition, some items with lower loadings

have been underlined in the table because they affected decisions about the construction of four sub-scales, or because there was some good theoretical justification for their inclusion.

Table 5.12 shows that items 11, 19 and 20 were rejected as they had low loadings on all four factors. The factors appeared to be interpretable, and four sub-scales were drawn up to correspond to the four factors (See also Table 5.13):

1. Sub-Scale Usefulness (CURUSE) was based on Factor 1 and reflects the usefulness of the mathematics curriculum. A high score on CURUSE means that pupils perceive mathematics as a useful subject. Items included were:

1 - Mathematical subjects are of great important to a country's development.

5 - Mathematical subjects are important for the study of science and engineering.

13 - Mathematical subjects are very important in realizing academic ambitions.

17 - It is important to know mathematics to get a good job.

18 - A thorough knowledge of advanced mathematics is the key to an understanding of our world in the twentieth century.

2. Sub-scale Difficulty (CURDIF): was based on Factor 2 and reflects the difficulty of the mathematics curriculum. A high score on CURDIF means that pupils perceive mathematics curriculum as an easy subject. Items included were:

3 - As far as I am concerned, mathematical subjects are more difficult than other subjects.

7 - I feel that, to understand mathematics better, I need help outside the school environment.

8 - In the study of mathematics if the pupils misses a few lessons it is difficult to catch up.

14 - It is difficult to understand the language and symbolism of mathematics.

15 - To understand mathematics I need to work harder than I do for other subjects.

Table 5.12 Factor Analysis of Curriculum Influence, Oblique 4 Factor Solution

Items	Factor 1	Factor 2	Factor 3	Factor 4
CURØ1	46	07	12	08
CURØ2	03	-01	07	46
CURØ3	17	67	-09	10
CURØ4	13	02	57	-16
CURØ5	37	03	05	03
CURØ6	04	-09	03	75
CURØ7	15	50	00	03
CURØ8	-08	61	22	-22
CURØ9	16	-01	-09	38
CUR10	-00	08	02	26
CUR11	-03	01	10	04
CUR12	04	01	72	-04
CUR13	60	18	-11	06
CUR14	22	49	-04	03
CUR15	-13	66	00	-01
CUR16	07	-03	37	04
CUR17	65	06	-07	04
CUR18	61	-02	08	-02
CUR19	-06	22	-04	17
CUR20	16	32	11	06

3. Sub-scale Length (CURLEN): was based on Factor 3, and represents a measure of the mathematics curriculum length. A high score on CURLEN reflects that pupils perceive the mathematics curriculum as not being too long. Items included were:

4 - Time allocated for mathematics in the timetable is adequate to complete the mathematics syllabi.

12 - Time allocated for mathematics are adequate to solve enough exercises from text book.

16 - Time allocated for mathematics is enough to do external exercises.

4. Sub-scale Relevance (CURRLV): was derived from the Factor 4, and measures the perceived relevance of mathematics curriculum to daily life issues. A high score on CURRLV reflects that pupils perceive the mathematics curriculum as more relevant to daily life issues. Items included were:

2 - Mathematical subjects are not useful for the problems of every day life.

6 - Examples and exercises of mathematical subject have no relation with daily issues.

9 - I believe that there is little need for mathematics to understand non scientific subjects.

10 - Mathematical subjects depend on theories and theoretical issues.

Once the four sub-scales had been constructed, a check was carried out to find out if all the items in each sub-scale were contributing to the measurement of a single construct. Each sub-scale was tested using the Reliability sub-program of (SPSS) which provides an internal consistency estimate of reliability and calculates the alpha coefficient. The reliability coefficients of the four sub-scales are quoted in Table 5.13. The range of the reliability coefficients (0.54 - 0.73) is remarkably good considering the small number of items involved in each sub-scale (3 to 5).

Table 5.13 Sub-scales Derived from Factor Analysis of Influence of Mathematics Curriculum

Sub-scales	Factor	Items	Reliability
Usefulness(CURUSE)	1	1,5,13,17,18	0.70
Difficult(CURDIF)	2	3,7,8,14,15	0.73
Length(CURLEN)	3	4,12,16	0.59
Relevance(CURRLV)	4	2,6,9,10	0.54

CHAPTER 6
RESULTS AND DISCUSSION

6.1 Pupils Attitudes Towards Mathematics (Questionnaire A)

6.1.1 Results and Analysis

Proposition 1 stated that:-
"In Iraq, for pupils in the third year of intermediate school - 14 years old, there are sex differencs in attitudes towards mathematics".

The beliefs and opinions of the pupils towards mathematics and other school subjects were ascertained by the administration of a free response questionnaire (Appendix A). Pupils were asked to indicate in descending order the three subjects they considered to be most enjoyable, least enjoyable, easiest, most difficult, most useful, least useful, most important and least important from among the thirteen school subjects. The main advantage of this questionnaire is that free responses were obtained from the pupils who could list whatever subjects they wished. Pupils' responses were scored according to the procedure outlined in Section 4.3.1. Four sub-scales were constructed for these responses, they were:-

ENJT: represents the enjoyment sub-scale as reflected by items 1 and 2.

EAST: represents the easiness sub-scale as reflected by items 3 and 4.

USET: represents the usefulness sub-scale as reflected by items 5 and 6.

ImpT : represents the importance sub-scale as reflected by items 7 and 8.

The first step was to compute the number of pupils who mentioned each subject as one of the three most enjoyable, least enjoyable, easiest, most difficult, most useful, least useful, most important and least important. This was carried out by hand from SpSS frequency tables. The following Tables 6.1 to 6.8 give the results of the analysis of pupils' responses; subjects being ranked in each case.

Table 6.1 Percentage of Pupils (Girls and Boys) Mentioning a Subject as "Most Enjoyable" (Response to Q1: Name Three Subjects you Enjoy Most at School).

Subjects	Percentage of Girls	Subjects	Percentage of Boys
Bio	41	Math	53
His	38	Arb	37
Eng	33	Bio	32.5
Rel	32.9	His	31
Arb	30	Phy	27
Math	28	Chm	26
Chem	17	Eng	21
Phy	16	PE	16
Geo	16	Rel.	15
PE	15	Geo	12
HEC	11	CNE	8
Art	7	Art	4
CNE	4	Ins	1

Note: Responses are arranged in descending order of enjoyment.

Legend: Arb. = Arabic, Eng. = English, His. = History, Geo. = Geography, CNE = Community and National Education, Phy. = Physics, Chm. = Chemistry, Bio. = Biology, Math. = Mathematics, Rel. = Religious Education, PE = Physical Education, Art = Art, Ins. = Industrial Education, HEC = Home Economics.

Table 6.1 shows that among boys, the position of mathematics was the first most enjoyable subject, while in the case of girls, it was the sixth after biology, history, languages and religious studies.

Table 6.2 shows that among boys, the position of mathematics was the fourth least enjoyable subject after foreign language, chemistry and geography, while among girls it was the second after physics.

Table 6.3 shows that among boys, the position of mathematics was the eighth subject in easiness, while among girls the position of mathematics was the last subject on the list, i.e. the most difficult.

Table 6.2 Percentage of Pupils (Girls and Boys) Mentioning a Subject as 'Least Enjoyable" (Response to Q2: Name Three Subjects you Enjoy Least At School)

Subjects	Percentage of Girls	Subjects	Percentage of Boys
Phy	45	Eng	38
Math	44	Chm	35
Chm	43	Geo	30
CNE	22	Math	27
Arb	21	Phy	25
Eng	19	Art	24
Geo	19	Bio	19
Art	15	His	19
His	14	Arb	13
PE	12	CNE	14
HEC	11	PE	4
Bio	6	Ins	3
Rel	-	Rel	0.4

Note: The subjects are arranged in ascending order of enjoyment.

Table 6.3 Percentage of Pupils (Girls and Boys) Mentioning a Subject a "Easy" (Response to Q3: Name three Subjects Which in Your Opinion are Most Easy).

Subjects	Percentage of Girls	Subjects	Percentage of Boys
HEC	45	PE	41
PE	40	Rel	39
Rel	37	His	34
Art	33	Art	31
His	28	Arb	29
Bio	25	Geo	25
Geo	21	CNE	20
Eng	15	Math	18
Arb	15	Phy	17
CNE	10	Bio	11
Phy	8	Eng	10
Chm	7.4	Ins	7.4
Math	7	Chm	6.2

Note: The subjects are arranged in descending order of their easiness.

Table 6.4 shows that among boys, the position of mathematics was the second after chemistry in difficulty, while among girls the position of mathematics was the third after physics and chemistry.

Table 6.4 Percentage of Pupils (Girls and Boys) Mentioning a Subject as "Most Difficult" (Responses to Q4: Name Three Subjects which in your Opinion are Most Difficult)

Subjects	Percentage of Girls	Subjects	Percentage of Boys
Chm	65	Chm	53
Phy	58.5	Math	50
Math	58	Bio	49
Eng	32	Eng	40
Arb	17	Phy	32
CNE	15	Arb	9.5
Geo	12	Geo	9.5
Bio	10	His	9
His	4	CNE	5
Art	2	Art	2
PE	0.8	PE	0.4
HEC	0.8	Ins	-
Rel	0.4	Rel	-

Note: The subjects are arranged in ascending order of their easiness.

Table 6.5 shows that among boys, the position of mathematics was the first in usefulness, while among girls the position of mathematics was the third after biology and english.

Table 6.6 shows that among boys, the position of mathematics was twelfth in least useful, while among girls the position of mathematics was the ninth before arabic, english, biology and religious studies.

Table 6.5 Percentage of Pupils (Girls and Boys) Mentioning a Subject as "Most Useful". (Response to Q5: Name Three Subjects which in Your Opinion are Most Useful)

Subjects	Percentage of Girls	Subjects	Percentage of Boys
Bio	53	Math	57
Eng	42	Bio	40.5
Math	39	Eng	40
Chm	31	Phy	39
Phy	27	Chm	34.4
Arb	27	Arb	29
His	21	His	12.4
HEC	13	Rel	9
CNE	12	Geo	9
Rel	12	PE	8
Geo	8	CNE	4.3
Art	5	Art	4.3
PE	5	Ins	1.4

Note: The subjects are arranged in descending order of usefulness.

Table 6.6 Percentage of Pupils (Girls and Boys) Mentioning a Subject as "Least Useful". (Response to Q6: Name Three Subjects Which in your Opinion are Least Useful)

Subjects	Percentage of Girls	Subjects	Percentage of Boys
Art	63	Art	60
PE	56	PE	38
HEC	56	Geo	32.5
CNE	20	Ins	24
Phy	16	His	21.5
Geo	15	CNE	18
His	13	Chm	17
Chm	13	Arb	12
Math	12	Phy	11
Arb	7	Eng	10
Eng	5	Bio	9.5
Bio	4	Math	9
Rel	3	Rel	5

Note: The subjects are arranged in ascending order of usefulness.

Table 6.7 shows that among boys, the position of mathematics was the first in importance, while among girls, the position was the third after biology and english.

Table 6.8 shows that among boys, the position of mathematics was the twelfth, at the same level with biology, in least importance, while among girls, the position of mathematics was the ninth above arabic, biology, english and religious studies.

The discussion of the results of the subjects ranking will be dealt with later, in Section 6.1.2 - A.

Table 6.7 Percentage of Pupils (Girls and Boys) Mentioning a Subject as "Most Important". (Response to Q7: Name Three Subjects Which in your Opinion are Most Important for Your Future)

Subjects	Percentage of Girls	Subjects	Percentage of Boys
Eng	52	Math	64
Bio	48	Phy	42
Math	47	Eng	42
Arb	30	Chm	41
Phy	28	Bio	40
Chm	26	Arb	21
His	18	PE	9
Geo	11	His	8
HEC	9	Geo	4
CNE	8	Art	3
Art	8	Ins	2
Rel	8	CNE	2
PE	3	Rel	1

Note: The subjects are arranged in descending order of importance.

Table 6.8 Percentage of Pupils (Girls and Boys) Mentioning a Subject as "Least Important". (Responses to Q8: Name Three Subjects Which in Your Opinion are Least Important for Your Future)

Subjects	Percentage of Girls	Subjects	Percentage of Boys
PE	55	Art	50
Art	52	PE	38
HEC	39	Geo	37
Geo	23	His	34
CNE	22	Chm	19
Chm	20	Arb	18
Phy	18	CNE	16
His	16	Ins	14
Math	12	Phy	13
Arb	7	Rel	9
Bio	7	Eng	8.6
Eng	5	Math	8
Rel	2	Bio	8

Note: The subjects are arranged in ascending order of importance.

To check whether there were significant differences between the attitude of boys and girls toward mathematics, the second step was to perform an analysis of variance according to the sex of pupils; the mean (M), standard deviation (S.D.), F-value, eta squared values and level of significance, resulting from the analysis, are shown in Table 6.9.

Table 6.9 shows that there are highly statistically significant differences in attitudes toward mathematics between boys and girls on all sub-scales, with boys in all cases having the more favourable attitudes.

Table 6.9 Analysis of Variance in Boys' and Girls' Attitudes Towards Mathematics

Sub-Scales	Boys M	Boys S.D	Girls M	Girls S.D	F Value	Eta Squared	Level of Significance
ENJT	2.15	0.87	1.79	0.83	16.35	0.04	0.0001**
EAST	1.59	0.72	1.40	0.58	8.38	0.20	0.0040**
USET	2.49	0.67	2.25	0.64	12.93	0.03	0.0004**
IMPT	2.60	0.62	2.32	0.69	17.17	0.04	0.0000**

** Significant at 1% level.

Since there are reasons to believe that sex differences might vary by social class (Alani, 1978), the third step was to perform an analysis of variance on the pupils' attitudes towards mathematics, according to sex and the school social class: working class, upper-middle class, and lower-middle class. The Summary of this analysis is shown in Table 6.10 (detailed tables for the sub-scales are reproduced in Appendix G, Tables G-A1 to G-A4).

Table 6.10 Summary of Analysis of Variance in Pupils' Attitudes Towards Mathematics, According to their Sex and School Social Class

Dependant Variable	Level of Significance: Sex	SCHSOC	Sex by SCHSOC
ENJT	0.000**	0.000**	0.000**
EAST	0.003**	0.000**	0.007**
USET	0.000**	0.000**	0.001**
IMPT	0.000**	0.000**	0.308^{ns}

** Significant at 1% level
ns Not significant.

Table 6.10 shows that in addition to the differences in attitude between the sexes being significant, the effect of the social class of the school (SCHSOC) on the pupil's attitude towards mathematics is highly significant for all the sub-scales. It also indicates that for sub-scales ENJT, EAST and USET, the differences between the sexes are themselves different for the school social class groups. However, for sub-scale IMPT, the table indicates that there is no significant interaction between sex and school social class. Hence, the effect of school social class can be investigated for sub-scale IMPT by computing the mean of the scores for pupils in each school social class group. The results are given in Table 6.11.

Table 6.11 Mean Scores of Pupils for Sub-Scale IMPT, According to the School Social Class

School Social Class	Mean
Upper-middle	2.66
Lower-middle	2.31
Working	2.41

Table 6.11 shows that the mean of the scores of the pupils in the upper-middle class school is the highest followed by the working class schools and then lower-middle class schools.

The mean scores of boys and girls on Sub-scales ENJT, EAST and USET were computed for each school social class group. Since the interaction was significant, means are shown separately for boys and girls. The results are given in Table 6.12.

Table 6.12 Mean Scores of Boys and Girls for Sub-Scales ENJT, EAST and USET, According to the School Social Class.

Sub-Scale	Mean Score of Working Class B	G	Mean Score of Lower-middle class B	G	Mean Score of Upper-middle class B	G
ENJT	1.57	1.83	2.42	1.87	2.47	1.65
EAST	1.26	1.35	1.75	1.49	1.75	1.36
USET	2.14	2.25	2.54	2.17	2.75	2.33

Table 6.12 shows that in working class schools, on the sub-scale ENJT, EAST and USET, very small differences between the means were in favour of girls, whereas in lower-middle class schools, on the three sub-scales, the very small mean differences were in favour of boys. The same results, are shown for the upper-middle class schools. From Table 6.9 it can be seen that for sub-scale IMPT, differences always favoured boys.

The fourth step was to perform an analysis of variance on the pupils' attitude towards mathematics according to sex and the occupation and education of their fathers and mothers. For the purpose of this analysis, and all the others hereafter, the occupation of the fathers were grouped into three categories replacing the detailed categorization of the Hall-Jones classification (Oppenheim, 1966 - see Appendix F) as follows:-

Category 1 : Professional and Managerial

Category 2 : Skilled Non manual

Category 3 : Manual, Semi-skilled and Unskilled.

This produced categories with more adequate numbers of cases. (No analysis of variance was carried out according to the occupation of the mothers, since the greatest majority of them were classified as - housewives).

The summary of the analysis of variance, according to fathers' occupation, is shown in Table 6.13 (detailed tables for the sub-scales are reproduced in Appendix G, Tables G-A5 to G-A8).

Table 6.13 Summary of Analysis of Variance in Pupils Attitudes Towards Mathematics, According to their Sex and Fathers' Occupation (OCCFAT)

	Level of Significance		
Dependant Variable	Sex	OCCFAT	Sex by OCCFAT
ENJT	0.000**	0.004**	0.223^{ns}
EAST	0.010**	0.001**	0.671^{ns}
USET	0.003**	0.000**	0.170^{ns}
IMPT	0.002**	0.001**	0.616^{ns}

** Significant at 1% level

ns Not significant

Table 6.13 shows that in addition to the differences in attitudes towards mathematics between the sexes being significant, the effect of the occupation of fathers (OCCFAT) on the pupils attitudes is highly significant for all the sub-scales. However, the interaction was never significant; that is the difference between the sexes reported in Table 6.9 did not appear to vary according to fathers' occupation. The effect of the fathers' occupation can be investigated for all the sub-scales by computing the mean of the scores for pupils in each fathers occupation group, the results are given in Table 6.14.

Table 6.14 shows that for sub-scales ENJT and IMPT, the mean of the scores of the pupils with fathers in Category 1 occupation is the highest followed by Category 3 and then Category 2. However, for sub-scales EAST and USET, the mean is the highest for Category 1 occupation followed by Category 2 then Category 3.

Table 6.14 Mean Scores of Pupils for all Sub-Scales, According to the Fathers' Occupation

Sub-Scales	Mean of Category 1 "professional"	Mean of Category 2 "Non-manual"	Mean of Category 3 "manual"
ENJT	2.22	1.77	1.91
EAST	1.69	1.43	1.38
USET	2.60	2.30	2.20
IMPT	2.66	2.27	2.44

The levels of education of the fathers and the mothers were grouped into four categories replacing the more detailed categorization of the Iraqi classification (Ministry of Planning, 1978 - see Section 4.3.1), as follows:-

Category 1 : Illiterate

Category 2 : Up to primary

Category 3 : Up to secondary

Category 4 : Higher education

This grouping produced categories with more adequate numbers of cases. (The above categorization are adopted for this analysis and all the others hereafter).

The Summary of variance, according to the fathers' education is shown in Table 6.15 (detailed tables for the sub-scales are reproduced in Appendix G, Tables G-A9 to G-A12).

Table 6.15 shows that in addition to the differences in attitudes towards mathematics between the sexes being significant, the effect of the education of fathers (EDUFAT) on the pupils attitudes is highly significant for sub-scales EAST, USET and IMPT and not significant for sub-scale ENJT. However, the interaction between sex and fathers' education is highly significant for sub-scales EAST and not significant for the others. Hence, for sub-scale EAST the mean of the scores of the pupils according to their sex and the education of their fathers were computed. The results are shown in Table 6.16.

Table 6.15 Summary of Analysis of Variance in Pupils Attitudes Towards Mathematics, According to their Sex and Fathers' Education (EDUFAT).

Dependant Variable	Level of Significance		
	Sex	EDUFAT	Sex by EDUFAT
ENJT	0.000**	0.282^{ns}	0.073^{ns}
EAST	0.006**	0.003**	0.008**
USET	0.001**	0.000**	0.061^{ns}
IMPT	0.000**	0.006**	0.429^{ns}

** Significant at 1% level

ns Not significant

Table 6.16 Mean Scores of Boys and Girls for Sub-scale EAST, According to the Fathers' Education

Sex	Mean of Category 1 "Illiterate"	Mean of Category 2 "Up to primary"	Mean of Category 3 "Up to Secondary"	Mean of Category 4 "Higher Education"
Boys	1.58	1.26	1.75	1.79
Girls	1.21	1.40	1.40	1.48

Table 6.16 shows that the mean of the scores of the boys is higher than girls in every fathers' education category except Category 2 where the girls' score is slightly higher.

However, for sub-scales USET and IMPT, the mean scores of the pupils according to the education of their fathers, were computed and shown in Table 6.17; no mean scores were computed for sub-scale ENJT because of non significance.

Table 6.17 Mean Scores of Pupils for Sub-Scales USET and IMPT, According to the Fathers' Education

Sub-Scales	Mean of Category 1 "Illiterate"	Mean of Category 2 "Up to primary"	Mean of Category 3 "Up to Secondary"	Mean of Category 4 "Higher Education"
USET	2.30	2.19	2.37	2.57
IMPT	2.45	2.44	2.27	2.62

Table 6.17 shows that for sub-scale USET, the mean of the scores of the pupils with fathers having Category 4 education is the highest followed by Categories 3, 1 and 2 respectively, for sub-scale IMPT, the mean of the scores of the pupils with fathers having Category 4 education is the highest followed by 1, 2 and 3 respectively.

The Summary of the analysis of variance, according to mothers' education is shown in Table 6.18 (detailed tables for the sub-scales are reproduced in Appendix G, Tables G-A13 to G-A16).

Table 6.18 shows that in addition to the differences between the sexes being significant,the effect of the education of the mothers (EDUMOT) on the pupils is significant for sub-scales EAST and USET and not significant for sub-scales ENJT and IMPT. However, the interaction between sex and mothers' education is significant for sub-scale ENJT and not significant for the others. Hence, for sub-scales EAST and USET the mean scores of the pupils according to the education of their mothers were computed and shown in Table 6.19.

Table 6.18 Summary of Analysis of Variance in Pupils Attitudes Towards Mathematics, According to Their Sex and Mothers' Education (EDUMOT)

Dependant Variable	Level of Significance		
	Sex	EDUMOT	Sex by EDUMOT
ENJT	0.000**	0.192^{ns}	0.006**
EAST	0.007**	0.018*	0.477^{ns}
USET	0.001**	0.004**	0.086^{ns}
IMPT	0.000**	0.132^{ns}	0.339^{ns}

** Significant at 1% level

* Significant at 5% level

ns Not significant

Table 6.19 Mean Scores of Pupils for Sub-Scales EAST and USET, According to the Mothers' Education.

Sub-Scales	Mean of Category 1 "Illiterate"	Mean of Category 2 "Up to primary"	Mean of Category 3 "Up to Secondary"	Mean of Category 4 "Higher Education"
EAST	1.37	1.48	1.54	1.71
USET	2.25	2.31	2.47	2.61

Table 6.19 shows that for sub-scales EAST and USET, the mean of the scores of the pupils with mothers having Category 4 education is the highest followed by Categories 3, 2, and 1 respectively.

However, for sub-scale ENJT the mean of the scores of the pupils according to their sex and the education of their mothers were computed. The results are shown in Table 6.20. No mean scores were computed for sub-scale IMPT because of non significance.

Table 6.20 Mean Scores of Boys and Girls, for Sub-Scale ENJT, According to the Mothers' Education

Sex	Mean of Category 1 "Illiterate"	Mean of Category 2 "Up to primary"	Mean of Category 3 "Up to Secondary"	Mean of Category 4 "Higher Education"
Boys	1.85	2.22	2.40	2.48
Girls	1.90	1.82	1.61	1.73

Table 6.20 shows that the mean of the scores of the boys is higher than girls in every mothers' education category except Category 1 where the girls' score is slightly higher.

6.1.2 Discussion

A - Subjects' Ranking

When the information from questionnaire A was analysed as to the ranking of topic preformance, it was found that:-

1) Mathematics was the first ranked subject in enjoyment among the boys and the sixth among the girls. However, boys ranked mathematics as the 4th least enjoyable subject while the girls ranked it second after physics. The result of the present investigation partly supports the findings of Gopal Rao (1973), Entwistle and Duckworth (1975) and keys and Ormerod (1976) in Britain. Gopal Rao found that among secondary schools pupils, boys placed mathematics as the 2nd among 12 subjects, while girls placed it in the 5th place among 12 subjects in order to "Most Enjoyed". He also found that boys placed mathematics as the 5th among 12 subjects, while girls placed it as the 2nd among 12 subjects in order of "least enjoyed". Entwistle and Duckworth found that among fifth year grammar school pupils, mathematics appeared in the 7th place in order of interest among 9 subjects in the case of both boys and girls. Keys and Ormerod found that among fourteen-year-old pupils, boys placed mathematics as the 4th among 15 subjects, while girls placed it in the 8th place among 15 subjects in order of preference.

2) Boys ranked mathematics as the 8th among 13 subjects, while girls placed it as the last subject in order of easiness. However, boys ranked mathematics as the 2nd among 13 subjects, and girls as the 3rd in order of difficulty. Also, the rank ordering of easiness for each subject showed that the physical sciences, chemistry and mathematics were indeed considered by the sample to be the most difficult subjects. These findings partly support the findings of Keys and Ormerod (1976). They found boys ranked mathematics as the 7th among 15 subjects while girls placed it as the 11th among 15 subjects in order of easiness. They also pointed out that:-

> "It would appear that the subjects which pupils considered to be the most difficult and which are the least popular are those where preference is most strongly influenced by perceived attainment viz: physical sciences, mathematics and foreign languages".

However, this study differs with Keys and Ormerod about this point. In this study, it was found that there is no relationship between perceived difficulty and popularity. The Iraqi pupils, while considering mathematics as a difficult subject, expressed great liking for it especially the boys.

3) Boys ranked mathematics as the 12th among 13 subjects, and girls as the 9th, in order of least useful subjects. However, boys ranked mathematics as the 1st subject, and girls as the 3rd, among 13 subjects in order of most useful. These findings partly support the findings of Gopal Rao (1973), who found that boys and girls ranked mathematics as the 1st among the 12 subjects in order of most useful, and in case of least useful, boys placed mathematics as the last subject and girls as the 11th among 12 subjects.

4) Boys ranked mathematics as the 1st among 13 subjects, and girls as the 3rd, in order of most important subjects. However, boys ranked mathematics as the 12th among 13 subjects, and girls as 9th in order of "least important".

B. Analysis of Variance

The analysis of variance on pupils' responses to questionnaire A revealed that:-

1) Boys considered mathematics to be more enjoyable than did the girls. This supports the findings of Prichard (1935), Shakespeare (1936) and Gopal Rao (1973), on the attitude of British pupils.

2) Boys considered mathematics to be an easier subject than did girls. This finding does not agree with that of Entwistle and Duckworth (1975) in Britain, which indicated that, among fifth year grammar school pupils mathematics appeared in the 4th place in order of difficulty among 9 subjects in case of both boys and girls.

3) Boys considered mathematics to be more useful than did girls. This conforms with the findings of Hilton and Berglund (1971) in the US, which indicated that girls did not recognize the usefulness of mathematics in their life plane, and the findings of Russell (1984) in the UK, which indicated that:-

> "It is apparent that the girls did not see mathematics as such a useful subject as the boys did".

4) Boys considered mathematics as more important than did the girls. This findings of the differences between boys and girls in their perception of the importance of the subject of mathematics conforms with that of Fennema and Sherman (1977b) of the US, who have pointed out that:-

> "Seeing no relevance of mathematics to an individual's future life is one of the strong forces that, if it does not actively discourage girls from learning, will certainly not encourage girls to put forth much effort in learning mathematics";

with Hindres (1977) who reported that:-

> "Boys aspire to mathematics related jobs and perceive greater relative articulation to future work of mathematics than girls";

with Atweh (1980) who concluded that:-

> "Girls do not see mathematics as relevant to their aspiration for careers";

and with Iker (1980) who reviewed many research and reached the same conclusions.

These findings of significant differences between boys and girls in their attitudes towards mathematics confirms similar findings by Gopal Rao (1973),

Pritchard (1935) and Shakespeare (1936) in Britain. All the three found that among children between the ages of ten and fourteen, mathematics, or a particular branch of it like arithmetic, appeared much lower in the list of subjects arranged in order of preference in the case of girls than in the case of boys. Only Harvey (1957) reported no significant differences in attitudes towards mathematics between boys and girls. The present investigation has produced evidence to support the proposition that, among Iraqi pupils, there are significant sex differences in attitudes towards mathematics. Therefore the available evidence suggests that proposition 1 is sustained.

The analysis of variance on the pupils responses according to their schools' social class and the occupation and education of parents revealed that:-

1) School Social Class:-

It was found that the effect of school social class on the pupils' attitude towards mathematics, was significant for all the sub-scales. However, the school social class affected the sexes differently on the "enjoyment", "easiness" and "usefulness" sub-scales, but not on the "importance" sub-scale.

On the "importance" sub-scale, it was found that pupils in upper-middle class schools gave the highest importance to mathematics followed by working class schools. This may be attributed to the desire of the upper class pupils to end up in professional careers (Doctor, Engineers, Scientists, etc.), and the desire of the working class pupils to end up as technicians, electricians, mechanics, etc.; in both cases mathematics would be perceived as important. While the lower-class pupils desire may be to end up as Clerks, teachers and Civil Servants where mathematics may not assume the same importance.

For the other sub-scales: "enjoyment", "easiness" and "usefulness", it was found that girls find mathematics easier, more enjoyable and more useful than boys in working class schools while in upper and lower-middle class schools the findings were in reverse; boys find mathematics more enjoyable, easier and more useful. This discrepancy may be attributed to the working class girls' perception that

their future lies through their education only and that any bright future cannot be obtained without proper achievement in mathematics, while the working class boys may be more interested in futures through apprenticeship and training.

2) Occupation of Fathers

It was found that the effect of the fathers' occupation, on the pupils' attitude towards mathematics, was significant for all the sub-scales. However, the fathers' occupation did not affect the sexes differently on any of the sub-scales.

On the "enjoyment" and "importance" sub-scales, it was found that pupils with fathers in the "professional" occupations scored the highest followed by pupils with fathers in the "manual" occupations (for the "importance" sub-scale this coincides with the findings about the effect of schools social class), finally followed by pupils with fathers in the "non-manual" occupations.

For the "easiness" and "usefulness" sub-scales, it was found that pupils with fathers in "professional" occupations scored the highest followed by the "non-manual" and the "manual" occupations respectively. This may indicate the positive effect of fathers on their sons' and daughters' attitude towards mathematics as their occupation rises.

3) Education of Fathers

It was found that the effect of the fathers education level, on the pupils' attitude towards mathematics, was significant for sub-scales "easiness", "usefulness" and "importance", and not significant for the sub-scale "enjoyment". However, the fathers' education level did not significantly affect the sexes differently on the "enjoyment", "usefulness" and "importance" sub-scales, but it did on the "easiness" sub-scale.

On the "usefulness" sub-scale, it was found that pupils with fathers in "higher education" category scored the highest, followed by the "up to secondary" category, followed by the "illiterate" category and finally with the "up to primary" category. However, on the "importance" sub-scale the sequence was "higher education", "illiterate", "up to primary" and "up to secondary". Although these

findings do not follow a fixed pattern, nevertheless, it coincides with the general expectations that pupils with fathers having high education levels generally have the best attitude towards mathematics.

For the "easiness" sub-scale, it was found that boys find mathematics easier than girls when the fathers are in the "higher eduction", or the "up to secondary" or the "illiterate" education categories. While girls find mathematics easier than boys when the fathers are in the "up to primary" education category; this coincides with the previous finding that girls in working class school find mathematics easier than boys (working class fathers tend to be mostly in the "up to primary" education level).

4) Education of Mothers

It was found that the effect of the mothers' education level, on the pupils' attitude towards mathematics, was significant for sub-scales "easiness" and "usefulness" and not significant for the sub-scales "enjoyment" and "importance". However, the mothers' education level did not significantly affect the sexes differently on the "easiness", "usefulness" and "importance" sub-scales but it did on the "enjoyment" sub-scale.

On the "easiness" and "usefulness" sub-scales, it was found that pupils with mothers in the "higher education" category scored the highest, followed by the "up to secondary" category, followed by the "up to primary" category and finally with the "illiterate" category respectively. It can be noted that there is a fixed pattern in these findings; the score rises as the level of education of the mothers rises. This coincides with the general expectation that the higher the level of the mothers education the more positive attitude of pupils towards mathematics.

For the "enjoyment" sub-scale, it was found that boys find mathematics more enjoyable than girls when the mothers are in the "higher education", or the "up to secondary" or the "up to primary" categories. While girls find mathematics more enjoyable than boys when the mothers are in the "illiterate" education category. The finding in the "illiterate" level of education of the mothers should not be taken very seriously since the scores are very close and the effect of an illiterate mother is

expected to be negligible.

6.2 The Influence of Teachers (Questionnaires B and C)

6.2.1 Results and Analysis

Proposition 2 postulated that:-

> "In Iraq, for pupils in the third year of intermediate school, differences in attitude between the sexes towards mathematics are influenced by their teacher".

For questionnaire (B), to test whether there were significant differences between the influence, as reported by the pupils, of mathematics teachers' on the two groups (boys and girls), the following analysis was performed. The first step was to perform an analysis of variance, the mean (M), standard deviation (S.D), F-Value, eta squared values and level of significance for the boys and girls resulting from the analysis are shown in Table 6.21.

Table 6.21 shows that the differences are highly statistically significant beyond the 1 per cent level between boys and girls on the influence of teacher in the direction favouring boys.

The second step was to perform an analysis of variance, according to sex and the school social class groups: working class, upper-middle class, and lower-middle class. The summary of this analysis is shown in Table 6.22 (detailed table is reporduced in Appendix G, Table G-B1).

Table 6.21 Analysis of Variance of Teachers' Influence on Boys and Girls

Sex	N	M	S.D	Eta-Square	F-Value	Level of Significance
Boys	209	42.15	10.82	0.01	7.07	0.0008**
Girls	227	39.71	8.24			

** Significant at 1% level.

Table 6.22 shows that in addition to the differences between the sexes being significant, the effect of the school social class (SCHSOC) on the teacher influence is significant. It also indicates that for teachers' influence (TEATOT) the differences between the sexes are themselves different for the school social class groups. Hence, the mean scores of teachers influence (TEATOT) on boys and girls were computed for each school social class groups. Since the interaction was significant, means are shown separately for boys and girls. The results are given in Table 6.23.

Table 6.22 Summary of Analysis of Variance of Teachers' Influence on Pupils, According to their Sex and School Social Class (SCHSOC)

	Level of Significance		
Dependant Variable	Sex	SCHSOC	Sex by SCHSOC
TEATOT	0.002**	0.000**	0.000**

** Significant at 1% level.

Table 6.23 Mean Scores of Teachers' Influence on Boys and Girls, According to the School Social Class.

	Mean Score of Working Class		Mean Score of Lower-middle class		Mean Score of Upper-middle class	
Sub-Scale	B	G	B	G	B	G
TEATOT	34.18	39.36	47.30	44.46	44.23	35.29

Table 6.23 shows that in working class schools, on the scale TEATOT, differences between the means were in favour of girls, while in lower-middle class schools and upper-middle class schools, the differences were in favour of boys.

The third step was to perform an analysis of variance of teachers influence on pupils according to sex and the occupation and education of their fathers and mothers.

The Summary of the analysis of variance, according to fathers' occupation, is shown in Table 6.24 (detailed table is reproduced in Appendix G, Table G-B2).

Table 6.24 Summary of Analysis of Variance of Teachers Influence on Pupils According to their Sex and Fathers Occupation (OCCFAT)

	Level of Significance		
Dependant Variable	Sex	OCCFAT	Sex by OCCFAT
TEATOT	0.020*	0.099^{ns}	0.007**

*Significant at 1% level.
^{ns} Not significant
* Significant at 5% level

Table 6.24 shows that in addition to the differences between the sexes being significant, the overall effect of occupation of father (OCCFAT) on the teacher influence is not significant. It also indicates that, the differences between the sexes are themselves different for the fathers' occupation categories. Hence, the mean scores of boys and girls on TEATOT were computed for each fathers' occupation category. Since the interaction was significant, means are shown separately for boys and girls. The results are shown in Table 6.25.

Table 6.25 Mean Scores of Teachers' Influence on Boys and Girls, According to the Fathers' Occupation

Sex	Mean of Category 1 "professional"	Mean of Category 2 "Non-manual"	Mean of Category 3 "manual"
Boys	44.92	42.37	39.79
Girls	39.61	38.09	41.10

Table 6.25 shows that the mean of the scores of boys is higher than girls in every fathers' occupation category except category 2 where the girls score is higher.

The Summary of the analysis of variance, according to fathers' education, is shown in Table 6.26 (detailed table is reproduced in Appendix G, Table G-B3).

Table 6.26 Summary of Analysis of Variance of Teachers' Influence on Pupils, According to their Sex and Fathers' Education (EDUFAT)

	Level of Significance		
Dependant Variable	Sex	EDUFAT	Sex by EDUFAT
TEATOT	0.013*	0.127^{ns}	0.000**

** Significant at 1% level
* Significant at 5% level
ns Not significant.

Table 6.26 shows that in addition to the differences between the sexes being significant, the effect of fathers' education (EDUFAT) on the teachers' influence is not significant. However the differences between the sexes are themselves different for the fathers' education category. Hence the mean scores of teachers' influence on boys and girls were computed for each fathers' education category. Since the interaction was significant means are shown separately for boys and girls. The results are shown in Table 6.27.

Table 6.27 Mean Scores of Teachers' Influence on Boys and Girls, According to the Fathers' Education

Sex	Mean of Category 1 "Illiterate"	Mean of Category 2 "Up to primary"	Mean of Category 3 "Up to Secondary"	Mean of Category 4 "Higher Education"
Boys	41.45	38.00	43.22	45.38
Girls	43.56	40.48	38.61	38.40

Table 6.27 shows that the mean score of the boys is higher than girls in Category 3 and Category 4, while girls mean score is higher than boys in Category 1 and Category 2.

The summary of analysis of variance, according to mothers' education is shown in Table 6.29 (detailed table is reproduced in Appendix G, Table G-B4).

Table 6.28 Summary of Analysis of Variance of Teachers' Influence on Pupils, According to their Sex and Mothers' Education (EDUMOT)

	Level of Significance		
Dependant Variable	Sex	EDUMOT	Sex by EDUMOT
TEATOT	0.007**	0.193^{ns}	0.007**

** Significant at 1% level
^{ns} Not significant

Table 6.28 shows that in addition to the differences between the sexes being significant, the effect of mothers' education (EDUMOT) on the teachers' influence is not significant. However, for the differences between the sexes are themselves different for the mothers' education category. Hence the mean score of teachers' influence on boys and girls were computed for each mothers' education category. Since the interaction was significant, means are shown separately for boys and girls. The results are given in Table 6.29.

Table 6.29 Mean Scores of Teachers' Influence on Boys and Girls, According to the Mothers' Education

Sex	Mean of Category 1 "Illiterate"	Mean of Category 2 "Up to primary"	Mean of Category 3 "Up to Secondary"	Mean of Category 4 "Higher Education"
Boys	39.44	42.95	42.38	44.91
Girls	40.42	40.86	38.17	35.68

Table 6.29 shows that the mean scores of the boys is higher than girls in every mothers' education category except Category 1 where the girls score is slightly higher.

For questionnaire (C); which was addressed to teachers of mathematics to investigate their expectations, the analysis of mean was performed. The mean scores for females and males mathematics teachers were computed and are shown in Table (6.30).

Table 6.30 Mean Scores of Males and Females Mathematics Teachers Showing the Differences in Expectation Between Boys and Girls

Items	Teachers Mean Male	Teachers Mean Female
Item 1	1.00	0.85
Items 2	G: 0.48	G: 0.47
	B: 0.52	B: 0.53

Table 6.30 shows that:-

1. For Item 1, which was a general question, the expectation of both sexes of mathematics teachers, as far as the capability of their pupils in mathematics, was high for both boys and girls.

2. For Items (2-6) concerning sex differences in teachers' expectations, the mean scores of expectation of both male and female mathematics teachers' were slightly higher on direction of boys.

6.2.2 Discussion

The analysis of variance of pupils responses to questionnaire B revealed that boys get influenced by their mathematics teachers more than girls. This finding conforms generally with that of Becker (1981) of the US, which indicated that teachers behave in ways that involve girls less in classroom interaction and give them less encouragement in mathematics. He also indicated that generally, teachers interacted informally with male students much more frequently than with female students. These contacts included conversations before and after class, joking and similar non academic interactions; with that of Fennema (1980) who indicated that teachers influenced females and males in their learning and feelings towards mathematics, and as a result of this differential treatment, females to a much greater extent than males, are receiving inadequate mathematical education in high schools; and with that of Schonborn (1975) who indicated that:-

> "From the first grade throughout high school, teachers pay more attention to males than females".

However in the case of the Iraqi pupils less emphasis should be given to the differential treatment of males and females in the class settings, since the schools are all single sex schools. However, what is important is the differential expectation of the teachers towards males and females as learners of mathematics. This was tested by a separate questionnaire (questionnaire C).

The above results support the relevant proposition 2.

The analysis of variance on the pupils responses according to their school social class, occupation and education of parents revealed that:-

1. School Social Class

It was found that the effect of the school social class, on the perceptions of pupils as to their teachers' influence, was significant. Also, the school social class affected the sexes perception differently.

On the scale measuring the perception of teachers' influence (TEATOT), it was found that girls in working class schools were more influenced by their teachers than boys were, this may be explained by the proposition, that working class families tend to neglect the education of their girls, hence, the only substantial influence they experience is that of the teacher. In the lower-middle class the differences in teachers' influence were found to narrow substantially, in favour of boys; indicating a healthy family interest in their education. In the upper-middle class, where the scores were heavily in favour of boys; indicating that the boys are under such pressure by their families to achieve high level of educational standard that the teachers' influence on them will rise sharply, yet the upper-middle girls are relieved of such pressure and hence display low scores of teachers' influence.

2. Occupation of Fathers

It was found that the effect of the fathers' occupation on the perceptions of pupils as to their teachers' influence, was not significant. However, the fathers occupation affected the sexes perception differently.

On the scale measuring the perception of teachers' influence (TEATOT), it was found that girls were more influenced by their teachers than boys were when the fathers are in the "manual" occupation category. While boys are more influenced by their teachers than girls, when the fathers are in the "non manual" or the "professional" cateogries. This may be explained by the same proposition as in the school social class case above.

3. Education of Fathers

It was found that the effect of the fathers' education, on the perceptions of pupils as to their teachers' influence, was not significant. However, the fathers' education affected the sexes perception differently.

On the scale measuring the perception of teachers'influence (TEATOT), it was found that girls were more influenced by their teachers than boys were when the fathers are in the "illiterate" or the "up to primary" education categories. While boys more influenced by their teachers than girls, when the fathers are in the "up to secondary" or the "higher education" categories. This finding coincides with the previous findings concerning the school social class, where the working class girls scored the highest; the fathers' occupation where girls with fathers in the "manual" occupations scored the highest.

4. Education of Mothers

It was found that the effect of mothers' education on the perceptions of pupils as to their teachers' influence, was not significant. However the mothers' education affected the sexes perception differently.

On the scale measuring the perception of teachers' influence (TEATOT), it was found that girls were more influenced by their teachers than boys were, when the mothers are in the "illiterate" category. While boys more influenced by their teachers than girls, when the mothers are in the "up to primary" or the "up to secondary" or the "higher education" categories. This again may be explained by the proposition given in 1 above.

Results of questionnaire (C) testing the expectation of teachers, showed slightly higher mean scores for boys irrespective of the sex of the teachers. The slightness of the difference may be attributed to the fact that they are single sex schools, hence less chance for differential treatment and expectations by the teachers. However, the fact of the higher scores for boys may be attributed to the role and perception of boys in a traditional Isalmic society.

6.3 The Influence of Parents (Questionnaire D)

6.3.1 Results and Analysis

Proposition 3 postulated that:-

> "In Iraq, for pupils in the third year of intermediate school, differences in attitude towards mathematics between the sexes are affected by parental influence".

To test this proposition, pupils answered questinnaire D twice (once for their mothers and once for their fathers). The analysis was the adoption of the cross-tabulation method. The chi-square test was used so that significant differences, if any, between boys and girls perceptions of the influence of their parents, could be substantiated.

It will be recalled that in Chapter 5 it was decided to analyse each item in questionnaire 1 separately. Two questions can be asked of each item. Firstly, are there differences between boys and girls answers? The ordinary chi-square test answers this question. Secondly, are there differences between the answers given for mother and father? The appropriate chi-square test is now that for testing symmetry in tables (Meddis, 1975). Thus in Tables 6.31 to 6.42, only the percentage answering "yes" has been tabulated, with the four chi-square values being calculated from the full table including "no" answers.

The results obtained and their brief analysis are as shown in Tables 6.31 to 6.42. Each of the tables is devoted to the results of one of the items of questionnaire D, and they are treated in turn.

Table 6.31 Percentage Answering "yes" to Question (1) "Does your Father/Mother Follow Scientific and Mathematics News and Programmes on TV and the News Papers?"

	Boys	Girls	X^2	
Father	80	84	1.0	ns
Mother	57	57	0.0	ns
X^2	33.6 **	42.2 **		

Table 6.31 shows that, when the percentage are compared, the differences between boys and girls are not significant for either father or mother, but there are significant differences between fathers and mothers for both boys and girls at the 1per cent level. Boys and girls considered that their fathers follow scientific and mathematical news and programs on TV and in news-papers more than their mothers do.

Table 6.32 Percentage Answering "yes" to question (2): "Does Your Father/Mother Help You to Solve Mathematics Exercises?"

	Boys	Girls	X^2	
Father	31	25	1.3	ns
Mother	15	12	0.5	ns
X^2	18.0 **	13 **		

As for the previous question, the differences between boys and girls are not significant, but there are significant differences between fathers and mothers at the 1 per cent level. Both boys and girls answered that their fathers helped them to solve mathematical problems more than their mothers did.

Table 6.33 Percentage Answering "yes" to Question (3): "Does your Father/Mother Expect you to Achieve Good Marks in Mathematics?"

	Boys	Girls	X^2	
Father	79	66	7.9	**
Mother	74	70	0.7	ns
X^2	2.7 ns	1.6 ns		

When the percentages are compared the differences between boys and girls are significant at the 1 per cent level for the expectation of their fathers and not significant for their mothers, but there are no significant differences between fathers and mothers. A higher percentage of boys answered that their fathers expected them to achieve good marks in mathematics more than did the girls.

Table 6.34 Percentage Answering "yes" to Question (4) "Does your Father/Mother Prefer to Converse and Argue about Scientific Matters?"

	Boys	Girls	X^2	
Father	33	41	2.5	ns
Mother	28	47	15.2	**
X^2	2.0 ns	1.9 ns		

There are significant differences between boys and girls at the 1 per cent level for their mothers; the other differences are not significant. A higher percentage of girls said that their mothers conversed and argued about mathematics more than did the boys.

Table 6.35 Percentage Answering "yes" to Question (5) "Does Your Father/Mother Encourage you to Study Mathematics?"

	Boys	Girls	X^2	
Father	85	79	2.6	ns
Mother	77	74	0.8	ns
X^2	6.1 *	2.2 ns		

No significant differences between boys and girls is observed, but the differences between parents encouragement are significant at the 5 per cent level, for boys and not signficant for girls; a higher percentage of boys answered that their fathers encouraged them to study mathematics more than their mothers did.

Table 6.36 Percentage Answering "yes" to Question (6) "Does Your Father/Mother Influence you in your Choice of Academic Future?"

	Boys	Girls	X^2	
Father	23	16	2.7	ns
Mother	17	22	1.4	ns
X^2	3.9 *	3.2 ns		

There are no significant differences between boys and girls, but the differences between fathers and mothers influences are significant at the 5 per cent level for boys and not significant for girls; higher percentage of boys answered that their fathers influenced them to choose their academic future more then their mothers did.

Table 6.37 Percentage Answering "yes" to Question (7): "Does your Father/Mother Regard Mathematics as One of the Less Useful Subject In General Life Matters?"

	Boys	Girls	X^2	
Father	9	16	4.6	*
Mother	8	25	21.2	**
X^2	0.2 ns	8.5 *		

There are significant differences between boys and girls at the 5 per cent level for their fathers and at the 1 per cent level for their mothers. There is also a significant difference between fathers and mothers at the 5 per cent level for girls but not for boys. Higher percentage of girls answered that their fathers and mothers regard mathematics as one of the less useful subjects, especially their mothers. However, it is noticed that very high percentages of both boys and girls answered that their parents regard mathematics as one of the useful subjects.

Table 6.38 Percentage Answering "yes" to Question (8): "Do you Feel that Your Father/Mother Wants you to Study Mathematics More than Other Subjects?"

	Boys	Girls	X^2	
Father	26	18	3.1	ns
Mother	26	26	0.0	ns
X^2	0.03 ns	5.1 *		

There are no significant differences between boys and girls, but there are significant differences between fathers and mothers at the 5 per cent level for girls only. A higher percentage of girls answered that their mothers want them to study mathematics,more than other subjects,compared to their fathers.

Table 6.39 Percentage Answering "yes" to Question (9): "Does Your Father/Mother Expect your Academic Future to be Literary?"

	Boys	Girls	X^2	
Father	14	29	12.2	**
Mother	16	39	26.1	**
X^2	0.5 ns	11.1 **		

There are significant differences between boys and girls at the 1 per cent level. There are significant differences between fathers and mothers at the 1 per cent level for girls only. Higher percentage of girls answered that their parents expect their academic future to be literary and especially their mothers. Presumably a higher percentage of both parents expect the academic future of their boys to be scientific.

Table 6.40 Percentage Answering "yes" to Question (10): "Does your Father/Mother Regard Mathematics as Difficult Subject?"

	Boys	Girls	X^2	
Father	33	42	3.6	ns
Mother	41	57	0.0	**
X^2	5.0 *	15.0 **		

There are significant differences between boys and girls at the 1 per cent level for their mothers only. The differences, between fathers and mothers are significant at the 5 per cent level for boys and at the 1 per cent level for girls; a higher percentage of girls answered that their parents regard mathematics as one of the difficult subjects, and especially their mothers whereas a lower percentage of boys answered that their parents regard mathematics as difficult subjects, especially their fathers.

Table 6.41 Percentage Answering "Yes" to Question (11): "Does your Father/Mother Show any Displeasure when your Marks in Mathematics are lower than other Subjects?"

	Boys	Girls	X^2	
Father	84	83	0.1	ns
Mother	79	83	1.3	ns
X^2	3.6 ns	0.00 ns		

Neither the differences between percentages responses of boys and girls nor the differences between fathers and mothers are significant.

Table 6.42 Percentage Answering "yes" to Question (12): "Does Your Father/Mother Expect you to go on to Gain a University Degree?"

	Boys	Girls	X^2	
Father	90	80	6.9	**
Mother	87	76	8.4	**
X^2	2.7 ns	5.4 *		

There are significant differences between boys and girls at the 1 per cent level. However, the differences between fathers and mothers expectation are significant at the 5 per cent level for girls and not significant for boys. A higher percentage of boys answered that their parents expects them to go on to gain a university degree, than girls. The percentage was especially low for girls' mothers. However, a very high percentage of both boys and girls answered that their parents expect them to go to gain a university degree. Since in 1980 only 19% of boys and 20% of girls in Iraq actually went on to university, these figures show a considerable lack of realism.

6.3.2 Discussion

According to Poffenberger and Norton (1956), parents affect the child's performance in mathematics in three ways:-

1. By parental expectations of child's achievement,
2. By parental encouragement,

and 3. By parents own attitude towards mathematics.

The questionnaire was originally designed to test for the above three components of parental influence, however, factor analysis of the results revealed that no such structure could be assumed (see Chapter 5). Hence, the individual questions were treated as separate items and their results were tabulated and analysed accordingly (see Tables 6.31-6.42). The results revealed that:-

1) Boys and girls answered that their fathers follow scientific and mathematical news more than their mothers do.

2) Girls tended to converse more with their mothers, about mathematics, than they did with their fathers. This may be attributed to the closeness of the girls to their mothers in a traditional Islamic society like Iraq.

3) A significantly higher percentage of girls perceived their parents to regard maths as a less useful subject, especialy for their mothers.

4) Generally higher percentages of both boys and girls felt that their mothers regarded maths as a difficult subject. This is expected due to the lower educational levels of mothers, as compared with fathers, in a male dominated society.

5) Higher percentages of both boys and girls answered that their fathers helped them to solve mathematical problems, more than their mothers did. However, it was found that both fathers and mothers help their sons more than their daughters, when they do. This finding is partly supported by Kelly (1982), who found that for a British sample, 31% of girls and 28% of boys received help from mothers, while 53% of girls and 61% of boys received help from their fathers, and, Sherman (1983) who concluded his US study, with the following:-

> "The tendency for girls to consult their fathers rather than their mothers for help with mathematics was confirmed (girls seven times more likely to consult father, one and a half times in first sample".

6) A higher percentage of boys answered that their fathers encouraged them to study mathematics more than their mothers did. Also, slightly higher percentage of boys felt that their parents encouraged them more than the girls. This finding may be attributed to the higher ambitions of the families towards the future of their sons.

7) A significantly higher percentage of girls felt that their mothers encouraged them to study maths, more than for their fathers. This again may be attributed to the closeness of mothers and daughters.

8) A higher percentage of boys answered that their parents expect them to achieve good marks in mathematics more than did the girls especially for their father.

9) A higher percentage of boys answered that their fathers influenced them to choose their academic future more than their mothers did. While the percentage of girls were higher in case of their mothers.

10) A higher percentage of girls answered that their parents expected their academic future to be literary, and especially their mother. But a higher percentage of both parents expect the academic future of their boys to be scientific. These differences may be attributed to the concern of the parents for their boys to have a good and viable career. Although the Arab population have a high regard and esteem for literature and humanities in general, however the choice of a secure and prosperous future is directly related to acquiring a profession such as engineers, scientists and doctors who have a higher status, income and career prospects than humanities related jobs and professions. Hence, the boys are encouraged to follow a scientifically based career.

11) A higher percentage of boys answered that their parents expect them to go on to gain a university degree, than girls. The percentage was especially low for girls' mothers. But it is noticed that a very higher percentage of both boys and girls answered that their parents expect them to go on to gain a university degree. This finding conforms with Kelly (1982), who found, in a UK sample, that parents attached just as much importance to girls education as to boys. But it differs from Maccoby and Jacklin (1974) who concluded that, parents often have lower educational expectations for daughters than for sons.

6.4 The Influence of the Curriculum (Questionnaire E)

6.4.1 Results and Analysis

Proposition 4 postulated that:-

"In Iraq, for pupils in the third year intermediate school, differences in attitude towards mathematics between the sexes are influenced by the content of the mathematics curriculum".

The first step in the analysis of the responses was to perform an analysis of variance to test whether there are significant differences between the influence of mathematics curriculum on the two groups (boys and girls). See Table 6.43.

Table 6.43 Analysis of Variance of Curriculum Influence on Boys and Girls

Sub-Scales	Boys M	Boys S.D	Girls M	Girls S.D	F-Value	Eta-Squared	Level of Significance
CURUSE	20.99	3.33	18.92	3.70	37.27	0.0791	0.0000**
CURRLV	11.96	3.42	11.22	3.51	4.96	0.1131	0.0263*
CURDIF	14.98	4.55	11.81	4.07	58.93	0.1196	0.0000**
CURLEN	10.22	2.75	9.43	2.14	11.47	0.0238	0.0008**

** Significant at 1% level
* Significant at 5% level.

Where:-

CURUSE: represents the useful sub-scale

CURRLV: represents the relevance sub-scale

CURDIF: represents the difficulty sub-scale

CURLEN: represents the length sub-scale.

Table 6.43 shows that the differences are highly statistically significant beyond the 1 per cent level between boys and girls on the three sub-scales CURUSE, CURDIF and CURLEN in the direction favouring boys. Also, there are statistically significant differences beyond the 5 per cent level between boys and girls on the sub-scale CURRLV, again in the direction favouring boys.

The second Step was to perform the analysis of variance, according to sex and the school social class groups: working class, upper-middle class, and lower-middle class. The Summary of this analysis is shown in Table 6.44 (detailed

tables for the Sub-Scales are reproduced in Appendix G, Tables G-E1 to G-E4).

Table 6.44 Summary of Analysis of Variance of Mathematics Curriculum Influence on Pupils, According to Their Sex and School Social Class (SCHSOC)

	Level of Significance		
Dependant Variable	Sex	SCHSOC	Sex by SCHSOC
CURLEN	0.001**	0.014*	0.006**
CURUSE	0.000**	0.162^{ns}	0.366^{ns}
CURRLV	0.015*	0.000**	0.776^{ns}
CURDIF	0.000**	0.000**	0.000**

** Significant at 1% level

* Significant at 5% level

ns Not significant.

Table 6.44 shows that in addition to the differences between the sexes being significant, the effect of the school social class (SCHSOC) on the curriculum influence is significant for three sub-scales CURLEN, CURRLV and CURDIF and not signficant for Sub-Scale CURUSE. It also indicates that for sub-scales CURLEN and CURDIF the differences between the sexes are themselves different for the school social class groups. However, for sub-scale CURRLV, there is no significant interaction between sex and school social class. Hence, the effect of school social class can be investigated for CURRLV by computing the mean of the scores for pupils in each school social class group . The results are given in Table 6.45.

Table 6.45 Mean Scores of Pupils for Sub-Scale CURRLV, According to the School Social Class

School Social Class	Mean
Upper-Middle	10.44
Lower-Middle	12.08
Working	12.34

Table 6.45 shows that the mean of the scores of pupils in the working class schools is the highest followed by the lower-middle class schools and the upper-middle class schools.

The mean scores of boys and girls on sub-scales CURLEN and CURDIF were computed for each school social class group . Since the interaction was significant, means are shown spearately for boys and girls. The result are shown in Table 6.46; no mean scores were computed for sub-scale CURUSE because of non significance.

Table 6.46 Mean Scores of Boys and Girls for Sub-Scales CURLEN and CURDIF, According to the School Social Class

Sub-Scale	Mean Score of Working Class		Mean Score of Lower-middle class		Mean Score of Upper-middle class	
	B	G	B	G	B	G
CURLEN	9.31	9.64	10.27	9.03	10.97	9.62
CURDIF	11.62	11.38	15.01	11.40	17.75	12.63

Table 6.46 shows that in working class schools, on the sub-scale CURLEN, very small differences between the means were in favour of girls, while on sub-scale CURDIF the small differences were in favour of boys. Whereas in

lower-middle class schools, on the two sub-scales, the differences between the means were in favour of boys. The same results, are shown in the upper-middle class schools. From Table 6.43, it can be seen that for sub-scales CURUSE and CURRLV, differences always favoured boys.

The third step was to perform an analysis of variance of curriculum influence on pupils according to sex and the occupation and education of their fathers and mothers.

The Summary of the analysis of variance, according to fathers' occupation, is shown in Table 6.47 (detailed tables for the Sub-Scales are reproduced in Appendix G, Tables G-E5 to G-E8).

Table 6.47 Summary of Analysis of Variance of Curriculum Influence on Pupils, According to their Sex and Fathers' Occupation (OCCFAT)

	Level of Significance		
Dependant Variable	Sex	OCCFAT	Sex by OCCFAT
CURLEN	0.002**	0.007**	0.145^{ns}
CURUSE	0.000**	0.041*	0.308^{ns}
CURRLV	0.044*	0.000**	0.915^{ns}
CURDIF	0.000**	0.000**	0.012*

** Significant at 1% level
* Significant at 5% level
ns Non significant

Table 6.47 shows that in addition to the differences between the sexes being significant, the effect of the occupation of the fathers (OCCFAT) on the pupils is highly significant for all the sub-scales. It also indicates that for sub-scale CURDIF, the differences between the sexes are themselves different for the fathers' occupation

categories. However, for sub-scales CURUSE, CURRLV and CURLEN the interaction was not significant; that is the difference between the sexes reported in Table 6.43 did not appear to vary according to fathers' occupation. The effect of the fathers' occupation can be investigated for the three sub-scales by computing the mean of the scores for pupils in each fathers' occupation category. The results are given in Table 6.48.

Table 6.48 shows that for sub-scale CURLEN the mean of the scores of pupils with fathers in Category 1 occupation is the highest followed by Category 3 and then Category 2. For sub-scale CURRLV, the mean is the highest for Category 3 occupation followed by Category 2 then Category 3. For sub-scale CURUSE, the mean is the highest for Category 1 occupation followed by Category 1 then Category 2.

Table 6.48 Mean Scores of Pupils for Sub-Scales CURUSE, CURRLV and CURLEN, According to the Fathers' Occupation

Sub-Scales	Mean of Category 1 "professional"	Mean of Category 2 "Non-manual"	Mean of Category 3 "manual"
CURLEN	10.47	9.31	9.75
CURRLV	10.87	11.08	12.37
CURUSE	20.25	18.94	20.33

The mean scores of boys and girls on sub-scale CURDIF were computed for each fathers occupation category. Since the interaction was significant, means are shown separately for boys and girls. The results are shown in Table 6.49.

Table 6.49 Mean Scores of Boys and Girls for Sub-Scale CURDIF, According to the Fathers' Occupation

Sex	Mean of Category 1 "professional"	Mean of Category 2 "Non-manual"	Mean of Category 3 "manual"
Boys	17.74	13.75	13.37
Girls	13.12	10.90	11.61

Table 6.49 shows that the mean of the scores of the boys is higher than the girls in every fathers' occupation category.

The Summary of analysis of variance, according to fathers' education, is shown in Table 6.50 (detailed tables for the sub-scales are reproduced in Appendix G, Tables G-E9 to G-E12).

Table 6.50 Summary of Analysis of Variance of Curriculum Influence on Pupils, According to their Sex and Fathers' Education (EDUFAT)

	Level of Significance		
Dependant Variable	Sex	EDUFAT	Sex by EDUFAT
CURLEN	0.001**	0.106^{ns}	0.126**
CURUSE	0.000**	0.290^{ns}	0.215^{ns}
CURRLV	0.030*	0.000**	0.540^{ns}
CURDIF	0.000**	0.000**	0.000*

** Significant at 1% level

* Significant at 5% level

ns Not significant

Table 6.50 shows that in addition to the differences between the sexes being significant, the effect of the education of the father (EDUFAT) on the pupils is highly significant for sub-scales CURRLV and CURDIF and not significant for sub-scales CURLEN and CURUSE. However, the interaction between sex and fathers education is significant for sub-scale CURDIF and not significant for the others. Hence for sub-scale CURDIF the mean of the scores of the pupils according to their sex and the education of their fathers were computed. The results are shown in Table 6.51.

Table 6.51 Mean Scores of Boys and Girls, for Sub-Scale CURDIF, According to the Fathers' Education.

Sex	Mean of Category 1 "Illiterate"	Mean of Category 2 "Up to primary"	Mean of Category 3 "Up to Secondary"	Mean of Category 4 "Higher Education"
Boys	13.83	12.19	15.54	17.54
Girls	11.56	11.29	11.37	12.85

Table 6.51 shows that the mean of the scores of boys is higher than girls in every fathers' education category.

However, for sub-scales CURRLV the mean scores of pupils according to the education of their fathers were computed and shown in Table 6.52; no mean scores were computed for sub-scales CURLEN and CURUSE because of non significance.

Table 6.52 Mean Scores of Pupils for Sub-Scale CURRLV, According to the Fathers' Education

Mean of Category 1 "Illiterate"	Mean of Category 2 "Up to primary"	Mean of Category 3 "Up to Secondary"	Mean of Category 4 "Higher Education"
13.18	11.93	11.23	10.85

Table 6.52 shows that for sub-scale CURRLV, the mean of the scores of pupils with fathers in Category 1 education is the highest followed by Categories 2, 3, and 4 respectively.

The Summary of analysis of variance, according to mothers' education is shown in Table 6.53 (detailed tables for the sub-scales are reproduced in Appendix G, Tables G-E13 to G-E16).

Table 6.53 shows that in addition to the differences between the sexes being significant, the effect of the education of the mothers (EDUMOT) on the pupils is significant for sub-scales CURLEN, CURRLV and CURDIF and not significant for sub-scale CURUSE. However, the interaction between sex and mothers' education is significant for sub-scale CURDIF and not significant for the others. Hence for sub-scale CURDIF the mean of the scores of the pupils according to their sex and the education of their mothers were computed. The results are shown in Table 6.54.

Table 6.53 Summary of Analysis of Variance of Curriculum Influence on Pupils, According to their Sex and Mothers' Education (EDUMOT)

Dependant Variable	Level of Significance		
	Sex	EDUMOT	Sex by EDUMOT
CURLEN	0.002**	0.047*	0.630^{ns}
CURUSE	0.000**	0.147^{ns}	0.383^{ns}
CURRLV	0.019*	0.000**	0.324^{ns}
CURDIF	0.000**	0.000**	0.034*

** Significant at 1% level

* Significant at 5% level

ns Not significant

Table 6.54 Mean Scores of Boys and Girls for Sub-Scale CURDIF, According to the Mothers' Education

Sex	Mean of Category 1 "Illiterate"	Mean of Category 2 "Up to primary"	Mean of Category 3 "Up to Secondary"	Mean of Category 4 "Higher Education"
Boys	13.00	14.54	16.07	18.00
Girls	11.59	11.62	11.80	13.31

Table 6.54 shows that the mean of the scores of boys is higher than girls in every mothers education category.

However, for sub-scales CURLEN and CURRLV the mean scores of the pupils according to the education of their mothers were computed and shown in Table 6.55; no mean scores computed for sub-scale CURUSE because of non significance.

Table 6.55 Mean Scores of Pupils for Sub-Scales CURLEN and CURRLV, According to the Mothers Education

Sub-Scale	Mean of Category 1 "Illiterate"	Mean of Category 2 "Up to primary"	Mean of Category 3 "Up to Secondary"	Mean of Category 4 "Higher Education"
CURLEN	9.74	9.45	10.23	10.39
CURRLV	12.46	11.69	10.71	10.55

Table 6.55 shows that for sub-scale CURLEN, the mean of the scores of the pupils with mothers in Category 4 education is the highest followed by categories 3, 1 and 2 respectively. However, for sub-scale CURRLV, the mean of the scores of the pupils with mothers in Category 1 education is the highest followed by Categories 2, 3 and 4 respectively.

6.4.2 Discussion

The analysis of variance on pupils responses to questionnaire E revealed that boys considered the mathematics curriculum more useful, more relevant, more easy and not as long, than did the girls (This suggests that the mathematics curriculum influences boys more than girls). This may be attributed to the fact that the Iraqi curriculum is based on the same textbooks and content for both boys and girls with similar teaching methods and styles. This may indicate that there are inherent male biases in the original design of the curriculum; a proposition which is consistent with the author's own experience. These findings conform with the UK findings of Becker (1981), the U S findings of Atweh (1980) and Leder (1974) who stated that:-

> "Mathematics textbooks tended to be biased toward the traditional interest of men".

The above findings support the stated curriculum proposition 4.

The analysis of variance on the pupils responses according to their schools social class, occupation and education of parents revealed that:-

1. School Social Class

It was found that the effect of the school social class, on pupils perceptions of the mathematics curriculum influence was significant for sub-scales "Length", "relevance" and "difficulty", and not significant for "usefulness" sub-scale. However, the school social class did not affect the sexes differently on the "usefulness" and "relevance" sub-scales but it did on the "length" and "difficulty" sub-scales.

On the "relevance" sub-scale, it was found that pupils in working class schools scored the highest, followed by the lower-middle class schools and finally followed by upper-middle class schools. This may be attributed to the simple life of the working class pupils where numbers and their manipulation constitute an important contribution to their daily life.

For the sub-scale "length", it was found that girls find the mathematics curriculum less long than boys in working class schools, while in lower and upper-middle class schools, the findings were in reverse; boys find the mathematics curriculum less long. For the sub-scale "difficulty", it was found that boys find the mathematics curriculum easier than girls in all schools social classes; which coincides with our general findings and expectations.

2. Occupation of Fathers

It was found that the effect of the fathers' occupation on pupils perceptions of the mathematics curriculum influence was significant for all the sub-scales. However, the fathers' occupation did not significantly affect the sexes differently on the "length", "usefulness" and "relevance" sub-scales, but it did on the "difficulty" sub-scale.

On the "length" sub-scale, it was found that pupils with father in the "professional" category scored the highest, followed by the "manual" category, followed by the "non-manual" category. However, on the relevance sub-scale the sequence was "manual", "non-manual" and "professional". This coincides with the findings concerning the schools social class (see above). Also, on the sub-scale "usefulness" the sequence was: "manual", "professional" and "non-manual".

For the "difficulty" sub-scale, it was found that boys find mathematics curriculum easier than girls in all fathers' occupation categories; which coincides with our general findings and expectations.

3. Education of Fathers

It was found that the effect of the fathers education level, on pupils perceptions of the mathematics curriculum influence was significant for sub-scales "relevance" and "difficulty" and not significant for the sub-scales "length" and "usefulness". However, the fathers education level did not significantly affect the sexes differently on the "length", "usefulness" and "relevance" sub-scales, but it did on the "difficulty" sub-scale.

On the "relevance" sub-scale it was found that pupils with fathers in the "illiterate" category scored the highest followed by the "up to primary" category, followed by the "up to secondary" category and finally with the "higher education" category. This finding coincides with the previous findings concerning the school social class, where the working class pupils scored the highest; and, the fathers' occupation, where pupils with fathers in the "manual" occupations scored the highest.

For the "difficulty" sub-scale, it was found that boys find mathematics easier than girls in all fathers education categories; which coincides with our general findings and expectations.

4. Education of Mothers

It was found that the effect of mothers education, on pupils perceptions of the mathematics curriculum influence was significant for sub-scales "length", "relevance" and "difficulty", and not significant for the sub-scale of

"usefulness". However, the mothers education level did not significantly affect the sexes differently on the "length", "usefulness" and "relevance" sub-scales, but it did on the "difficulty" sub-scale.

On the "length" sub-scale, it was found that pupils with mother in the "higher education" category scored the highest, followed by the "up to secondary" category, followed by the "illiterate" category and finally with the "up to primary" category. Although these findings do not follow a fixed pattern, nevertheless, it coincides with the general expectations that pupils with fathers having higher education levels generally have the best perceptions to the mathematics curriculum. However on the "relevance" sub-scale the sequence was: "illiterate", "up to primary", "up to secondary" and "higher education". This finding coincides with the previous findings concerning the school social class, where the working class district pupils scored the highest; the fathers' occupation, where pupils with fathers in "manual" occupations scored the highest; and, the fathers' education, where pupils with fathers in the "illiterate" education scored the highest.

For the "difficulty" sub-scale, it was found that boys find the mathematics curriculum easier than girls in all mothers education categories; which coincides with our general findings and expectations.

CHAPTER 7

SUMMARY AND CONCLUSIONS

7.1 Summary

The main conclusions which can be drawn from this investigation may be briefly summarized as follows:-

7.1.1 Pupils Attitudes Towards Mathematics

1. There are significant sex differences in pupils attitudes towards mathematics. Scores were in favour of boys.
2. In working class schools, girls had more positive attitudes towards mathematics than boys.
3. Pupils with fathers in the "professional" occupational category scored the highest with respect to attitudes towards mathematics.
4. Pupils with fathers in the "higher education" category scored the highest with respect to the "usefulness" and "importance" of mathematics.
5. Pupils with mothers in the "higher education" category scored the highest and the scores decreased as the level of the mothers education decreased, with respect to the "easiness" and "usefulness" of mathematics.

Therefore, it can be concluded that generally the attitude of pupils towards mathematics improves as the level of their school social class, and the occupation and education of their parents rises.

7.1.2 Teacher's Influence

1. There are significant differences between boys and girls as to their perception of their teacher's influence. Boys perceived the influence more positively than girls.

2. Girls in working class schools scored higher than boys with respect to teacher's influence. But boys scored higher in the upper and lower-middle class schools.
3. Girls with fathers in the "manual" occupational category scored higher than boys. But boys scored higher with fathers in the "non-manual" and the "professional" categories.
4. Girls with fathers and mothers in the "illiterate" educational category scored higher than boys. But boys with other educational categories scored higher.
5. Teachers generally expected boys to be higher achievers than girls in mathematics.

Therefore, it can be concluded that there are sex differences in the perception of the teachers influence. However, an important finding was that girls in working class schools and with parents in lower educational and occupational categories, expressed more positive perception of their teachers influence than did the boys.

7.1.3 Parents' Influence

1. Pupils perceived their parents to regard mathematics as a useful subject; to expect them to attain high education levels, and to associate scientific futures with the boys. However a higher percentage of girls perceived their parents to regard mathematics as a difficult subject.
2. Pupils perceived their fathers to be more interested in mathematics and to be more helpful to them in their study of mathematics, compared with their mothers. However, boys perceived their fathers to give them more encouragement and have more influence on their future than their mothers did. Also, boys considered that their fathers had higher expectations for them than did girls.

3. Pupils perceived the influence of their mothers to be generally less than the influence of the fathers in terms of interest, help and expectation. However, girls were closer to their mothers than boys in terms of conversations, interaction, and encouragement.

7.1.4 Curriculum Influence

1. There are significant differences between boys and girls as to their perception of the mathematics curriculum. Boys perceived the influence more positively than girls.
2. Pupils in working class schools regarded the mathematics curriculum as having more relevance to their daily life issues than pupils in the upper and lower-middle class schools.
3. Girls in the working class schools regarded the mathematics curriculum as being easier and less long than boys did.
4. Pupils with fathers in the "manual" occupational category regarded the mathematics curriculum as having more relevance to their daily life issues and as being more useful than did pupils in other occupational categories.
5. Pupils with fathers in the "illiterate" educational category regarded the mathematics curriculum as having more relevance to their daily life issues than did pupils in other educational categories. The relevance decreases as the educational level increases.
6. Pupils with mothers in the "illiterate" educational category regarded mathematics curriculum as having more relevance than did pupils in other educational categories. The relevance decreases as the educational level of mothers increases.

Therefore, it can be concluded that the perception of pupils as to the relevance of the mathematics curriculum to their daily life decreases as the social class and educational, and occupational levels of the parents increases.

7.2 Implication and Suggestions for Future Research

Based upon the above, the following recommendations are made:

1) More consideration needs to be given to bringing about in girls a more positive attitude towards mathematics. This is a task which involves society at large in terms of widening career opportunities; parents in encouraging their daughters to pay more attention to the values of mathematics; the Ministry of Education in developing syllabi and producing text books with more women teachers; and finally teachers in their approach to the subject.

2) More emphasis generally needs to be given to the increasing relevance of mathematics; this may require a technological orientation to highlight its usefulness; sufficient time needs to be allocated for the learning of all elements of the syllabi in every year and there needs to be greater provision for feedback and remedial work.

In addition, in my experience as a mathematics teacher, I recommend that:

3) The mathematical competence necessary for teachers in the intermediate schools needs examining and appropriate review. The methods of preparing such teachers need to include learning to define objectives, grading of content, use of the most effective teaching and evaluation techniques, including the role of practical and project work and, in some depth, the learning processes in

relation to the cognitive, affective and creative aspects of life. This will necessitate a considerable expansion and revision of in-service training facilities.

With regard to future research, the results of this study have suggested:

1) Further studies should be conducted to other levels and stages to study the influence of sex on achievement in and attitudes towards mathematics, especially to find out whether the findings in this study hold true for the pupils of primary and secondary levels.

2) Further investigation could be made into sex differences in achievement in the vaious topics of mathematics such as sets, operation, logic, etc.

3) There is room for the study of the interrelationships of personality and motivational variables, classroom variables, teachers variables, peer variables, in order to study the contribution of these factors to prediction of mathematics achievement.

APPENDICES

APPENDICES

A : Open-ended questionnaire (Attitudes towards mathematics)

B : Likert type questionnaire (Teachers influence)

C : Yes or No questionnaire (Teachers expectation)

D : Yes or No questionnaire (parents influence)

E : Likert type questionnaire (curriculum influence)

F : The Hall-Jones Scale of Occupational Prestige

G : Detailed analysis of responses to questionnaires A, B, and E.

APPENDIX A

Questionnaire A: Attitudes Towards Mathematics

Name: School:

Sex: Class:

1. Name three subjects you ENJOY MOST at school.

    1.

    2.

    3.

2. Name three subjects you ENJOY LEAST at school.

    1.

    2.

    3.

3. Name three subjects which in your opinion are MOST EASY.

    1.

    2.

    3.

4. Name three subjects which in your opinion are MOST DIFFICULT.

    1.

    2.

    3.

5. Name three subjects which in your opinion are MOST USEFUL.

    1.

    2.

    3.

6. Name three subjects which in your opinion are LEAST USEFUL.

1.

2.

3.

7. Name three subjects which in your opinion are MOST IMPORTANT for your future.

1.

2.

3.

8. Name three subjects which in your opinion are LEAST IMPORTANT for your future.

1.

2.

3.

الاسم : المدرسة :

الجنس: الصف :

١- اكتب ثلاثة مواضيع مدرسية يعجبك ان تدرسها .

١.
٢.
٣.

٢- اكتب ثلاثة مواضيع مدرسية لا يعجبك ان تدرسها .

١.
٢.
٣.

٣- اكتب ثلاثة مواضيع مدرسية سهلة في نظرك .

١.
٢.
٣.

٤- اكتب ثلاثة مواضيع مدرسية صعبة في نظرك .

١.
٢.
٣.

٥. اكتب ثلاثة مواضيع مدرسية اكثر فائدة في نظرك .

١.
٢.
٣.

٦- اكتب ثلاثة مواضيع مدرسية اقل فائدة في نظرك .

١.
٢.
٣.

٧- اكتب ثلاثة مواضيع مدرسية مهمة لمستقبلك الدراسي .

١.
٢.
٣.

٨- اكتب ثلاثة مواضيع مدرسية اقل اهمية لمستقبلك الدراسي .

١.
٢.
٣.

APPENDIX B

Questionnaire B : Teachers Influence

Name: School:

Sex: Class:

Instruction

On the following pages you will find various statements. For each statement please indicate whether you Strongly Agree (SA), Agree (A) but not strongly, Strongly Didagree (SD), Disagree (D) but not strongly, or are Uncertain (U). When you have decided, indicate what you feel by circling the letters of your choice.

Example 1 : (this one has been done for you, the person disagree's).

History is my favourite subject	SA	A	U	D	(SD)

Example 2 : (this is for you to practise on).

Arabic is my favourite subject	SA	A	U	D	SD

All the statements in the following pages asks you to answer in the same way.

1.	I feel comfortable with the pleasent way the Mathematics teacher treat me.	SA	S	U	D	SD
2.	Mathematics teacher encourages me a lot to do well in mathematics.	SA	S	U	D	SD
3.	The way the mathematics teacher teaches makes me like the subject.	SA	S	U	D	SD
4.	Mathematics teacher concentrates on only some of the pupils in the class.	SA	S	U	D	SD
5.	Our mathematics teacher spend a lot of effort trying to help weak pupils in mathematics	SA	S	U	D	SD

6.	Our mathematics teacher does not encourage us to ask questions.	SA	S	U	D	SD
7.	Our mathematics teacher helps pupils outside class hours.	SA	S	U	D	SD
8.	Our mathematics teacher becomes very happy when one of the weak pupils in mathematics obtains a high mark in the exam.	SA	S	U	D	SD
9.	Our mathematics teacher explains to us many different ways for the solution of problems.	SA	S	U	D	SD
10.	Our mathematics teacher cooperate with my family to raise my standard in mathematics.	SA	S	U	D	SD
11.	Our mathematics teacher encourages us to find different methods to solve the same problem.	SA	S	U	D	SD
12.	Our mathematics teacher helps us to understand the lessons by quoting external examples.	SA	S	U	D	SD

الاسم : المدرسة :

الجنس : الصف :

تعليمات

في الصفحات التالية سوف تجد بعض العبارات، المطلوب هو ان تقرر ما اذا كنت موافقه بشده (م ش)، موافقه فقط (م)، غير موافقه بشده (غ ش)، غير موافقه فقط (غ)، او غير متأكد (ك) على كل عباره.

عندما تقرر ضع دائره حول الحرف او الحروف الداله على الرأي الذي اخترته.

مثال: (الشخص في هذا المثال موافقه جداً).

التاريخ هو مادتي المفضله (م ش) م ك غ غ ش

مثال للتدريب:

اللغه العربيه مادتي المفضله م ش م ك غ غ ش

اجب على كل العبارات بنفس الطريقه اعلاه.

١- اني اشعر براحه من طريقة معاملة مدرس الرياضيات لي .

٢- مدرس الرياضيات يشجعني كثيراً .

٣- طريقة تدريس مدرس الرياضيات تجعلني احب المادة .

٤- مدرس الرياضيات يركز اثناء الدرس على مجموعة من الطلاب فقط .

٥- مدرس الرياضيات يبذل جهد كبير لمساعدة الطلاب الضعفاء في الرياضيات .

٦- مدرس الرياضيات لا يشجعنا على طرح اسئلة اثناء الدرس .

٧- مدرس الرياضيات يساعد الطلاب خارج الوقت المحدد للدرس .

٨- مدرس الرياضيات يفرح كثيراً عندما احد الطلاب الضعفاء يأخذ درجة عالية في الامتحان .

٩- مدرس الرياضيات يشرح لنا طرقه مختلفة في حل المسألة الواحدة .

١٠- مدرس الرياضيات يتعاون مع اهلي من اجل رفع مستواي في الرياضيات .

١١- مدرس الرياضيات يشجعنا على ايجاد طرقه مختلفة في حل المسألة الواحدة .

١٢- مدرس الرياضيات يساعدنا على فهم الموضوع بواسطة جلب امثلة خارجية .

APPENDIX C

Questionnaire C: Teachers Expectation

Name: School:

Sex:

For the following questions, if your answer is YES then please delete NO. If it is NO then delete YES.

1. Do you believe that only pupils with special abilities can comprehend mathematics? YES/NO

2. Are girls, in general, more concerned with their scientific future than boys? YES/NO

3. Do you believe that for girls at the intermediate stage their concern about social and life issues effect their progress in mathematics? YES/NO

4. Do you think that girls, in general, feel that mathematics is not important for their general life? YES/NO

5. Do you believe that girls like mathametics more than boys? YES/NO

6. Do you believe that there are natural factors which makes girls less able in mathematics than boys? YES/NO

الاسم : المدرسة :

الجنس :

الاسئله التاليه ، اذا كان جوابك نعم +شطب كلا . واذا كان جوابك كلا +شطب كلمة نعم .

١- هل في اعتقادك بأن الطلاب الذين لديهم قابليه خاصه قادرين على +تيعاب برياضيات اكثر من بقيه الطلاب ؟ نعم / كلا

٢- هل الطالبات بصوره عامه اكثر اهتمام بمستقبلهم العلمي من الطلاب ؟ نعم / كلا

٣- هل في اعتقادك بأن الطالبات في المرحله المتوسطه اهتمامهم بالامور الاجتماعيه يؤثر على تقدمهم في الرياضيات ؟ نعم / كلا

٤- هل تعتقد بأن الطالبات بصوره عامه يشعرون بأن الرياضيات غير مهمه لحياتهم العامه ؟ نعم / كلا

٥- هل تعتقد بأن الطالبات تعجبهم الرياضيات اكثر من الاولاد ؟ نعم / كلا

٦- هل في اعتقادك بأن هنالك عوامل طبيعيه تجعل البنات اقل قابليه من الاولاد في الرياضيات ؟ نعم / كلا

APPENDIX D

Questionnaire D : Parents Influence

Name: School:

Sex: Class:

Father's Occupation:

Mother's Occupation:

Put an X in the appropriate box.

Father's Education	Illiterate	☐
	Read and Write	☐
	Primary School	☐
	Intermediate School	☐
	Secondary School	☐
	Higher Institute	☐
	University	☐
	Others	☐
Mother's Education:	Illiterate	☐
	Read and Write	☐
	Primary School	☐
	Intermediate School	☐
	Secondary School	☐
	Higher Institute	☐
	University	☐
	Others	☐

For questions 1-12, if your answer is YES then please delete NO. If the answer is NO then please delete YES.

1. Does your Father/Mother follow scientific and mathematics news and programmes on radio, T.V. and the newspapers? YES/NO

2. Does your Father/Mother help you to solve mathematics exercise? YES/NO

3. Does your Father/Mother expect you to achieve good marks in mathematics? YES/NO

4. Does your Father/Mother prefer to converse and argue about scientific matters? YES/NO

5. Does your Father/Mother encourage you to study mathematics? YES/NO

6. Does your Father/Mother influence you in your choice of academic future? YES/NO

7. Does your Father/Mother regard mathematics as one of the unuseful subject in general life matters? YES/NO

8. Do you feel that your Father/Mother wants you to study mathematics more than other subjects? YES/NO

9. Does your Father/Mother expect your academic future to be literary? YES/NO

10. Does your Father/Mother regard mathematics as difficult subject? YES/NO

11. Does your Father/Mother show any displeasure when your markes in mathematics are lower than other subjects? YES/NO

12. Does your Father/Mother expects to go on to gain a university degree? YES/NO

الاسم : الورشة :

الجنس : العمر :

مهنة الاب :

مهنة الام :

ضع علامة X في المربع المناسب .

التحصيل العلمي للاب

- امي
- يقرأ ويكتب
- ضريح ابتدائيه
- ضريح متوسطة
- ضريح اعداديه
- ضريح معهد عالي
- ضريح جامعه
- شهاده عليا اخرى

التحصيل العلمي للام

- اميه
- تقرأ وتكتب
- ضريبة ابتدائيه
- ضريبة متوسطة
- ضريبة اعداديه
- ضريبه معهد عالي
- ضريبة جامعة
- شهاده عليا اخرى

الاسئلة من ١ - ١٢ ، اذا كان جوابك نعم اشطب كلمة كلا . اما اذا كان جوابك كلا فاشطب كلمة نعم .

١- هل والدك / والدتك يتابع الاخبار والبرامج العلمية في الراديو والتلفزيون والصحف اليومية ؟ كلا / نعم

٢- هل والدك / والدتك يساعدك في عمل تمارين الرياضيات ؟ كلا / نعم

٣- هل والدك / والدتك يتوقع منك درجة عالية في الرياضيات ؟ كلا / نعم

٤- هل والدك / والدتك يفضل العدد والمناقشة في المواضيع العلمية ؟ كلا / نعم

٥- هل والدك / والدتك يشجعك على دراسة الرياضيات ؟ كلا / نعم

٦- هل والدك / والدتك يؤثر عليك في اختيارك مستقبلك الدراسي ؟ كلا / نعم

٧- هل والدك / والدتك يعتبر الرياضيات من المواضيع الغير مفيدة في الحياة العامة ؟ كلا / نعم

٨- هل تشعر بأن والدك / والدتك يريدون منك ان تدرس الرياضيات اكثر من بقية المواضيع المدرسية الاخرى ؟ كلا / نعم

٩- هل والدك / والدتك يتوقع مستقبلك الدراسي ان يكون ادبيا ؟ كلا / نعم

١٠- هل والدك / والدتك يعتبر الرياضيات من المواضيع الصعبة ؟ كلا / نعم

١١- هل والدك / والدتك ينزعج عندما تكون درجتك اقل من بقية الدروس ؟ كلا / نعم

١٢- هل والدك / والدتك يتوقع منك حضورك على شهادة جامعية ؟ كلا / نعم

APPENDIX E

Questionnaire E : Curriculum Influence

Name: School:

Sex: Class:

Instructions

On the following pages you will find various statements. For each statement please indicate whether you Strongly Agree (SA), Agree (A) but not strongly, Strongly Disagree (SD), Disagree (D) but not strongly, or are Uncertain (U). When you have decided, indicate what you feel by circling the letters of your choice.

Example 1: (this one has been done for you, the person agree's).

Mathematics is the Central Subject in the curriculum.	SA	(A)	U	D	SD

Example 2 : (this is for you to practise on).

Mathematics is my favourite subject.	SA	A	U	D	SD

All the statements in the following pages ask you to answer in the same way.

Thank you.

1.	Mathematical subjects are of great important to a country's development.	SA	A	U	D	SD
2.	Mathematical subjects are not useful for the problems of every day life.	SA	A	U	D	SD
3.	As far as I am concerned, mathematical subjects are more difficult than other subjects.	SA	A	U	D	SD
4.	Time allocated for mathematics in the timetable is adequate to complete the mathematics syllabi.	SA	A	U	D	SD
5.	Mathematical subjects are important for the study of science and engineering.	SA	A	U	D	SD
6.	Examples and exercises of mathematical subjects have no relation with daily issues.	SA	A	U	D	SD
7.	I feel that, to understand mathematics better, I need help outside the school environment.	SA	A	U	D	SD
8.	In the study of mathematics if the pupils misses a few lessons it is difficult to catch up.	SA	A	U	D	SD
9.	I believe that there is little need for mathematics to understand non scientific subjects.	SA	A	U	D	SD
10.	Mathematical subjects depend on theories and theoretical issues.	SA	A	U	D	SD
11.	I believe that if I have enough time I will be able to cope easily with mathematical subjects.	SA	A	U	D	SD
12.	Time allocated for mathematics are adequate to solve enough exercises from the textbooks.	SA	A	U	D	SD
13.	Mathematical subjects are very important in realizing academic ambitions.	SA	A	U	D	SD
14.	It is difficult to understand the language and symbolism of mathematics.	SA	A	U	D	SD
15.	To understand mathematics I need to work harder than I do for other subjects.	SA	A	U	D	SD
16.	Time allocated for mathematics is enough to do external exercises.	SA	A	U	D	SD
17.	It is important to know mathematics to get a good job.	SA	A	U	D	SD
18.	A thorough knowledge of advanced mathematics is the key to an understanding of our world in the twentieth century.	SA	A	U	D	SD

19.	Most of the mathematical subjects learning has little value for a person.	SA	A	U	D	SD
20.	I believe that mathematics curriculum need to reduce subjects.	SA	A	U	D	SD

الاسم : المدرسة :

الجنس : الصف :

تعليمات

في الصفحات التالية سوف تجد بعض العبارات المطلوب هو ان تقرر ما اذا كنت موافقه بشده (م ش) ، موافقه فقط (م) ، غير موافقه بشده (غ ش) ، غير موافقه فقط (غ) ، او غير متاكد (ك) على كل عباره .

عند ما تقرر ضع دائره حول الحرف او الحروف الداله على رأيك الذي اخترته .

مثال للتوضيح : (الشخص في هذا المثال موافقه فقط)

الرياضيات هو مركز المنهج المدرسي م ش (م) ك غ غ ش

مثال للتدريب :

الرياضيات هو مادتي المفضله . م ش م ك غ غ ش

اجب على كل العبارات بنفس الطريقه اعلاه .

١- مواضيع الرياضيات مهمة جداً في تطور العلم.	غ ش	غ	ك	٢	ش
٢- مواضيع الرياضيات غير مفيدة في المشاكل اليومية.	غ ش	غ	ك	٢	ش
٣- في اعتقادي مواضيع الرياضيات أكثر صعوبة من بقية المواضيع الأخرى.	غ ش	غ	ك	٢	ش
٤- الوقت المقرر للرياضيات في الجدول كافي في المجال مزاولة الرياضيات.	غ ش	غ	ك	٢	ش
٥- مواضيع الرياضيات مهمة في دراسة العلوم والهندسة.	غ ش	غ	ك	٢	ش
٦- أمثلة وتمارين مواضيع الرياضيات ليس لها علاقة بالحياة اليومية.	غ ش	غ	ك	٢	ش
٧- إني أشعر لفهم واستيعاب مواضيع الرياضيات أكثر، أحتاج إلى مساعدة خارجية.	غ ش	غ	ك	٢	ش
٨- في دراسة الرياضيات، إذا الطلاب فقدوا بعض الدروس سوف يكون صعب عليهم فهمها لوحدهم.	غ ش	غ	ك	٢	ش
٩- إني أعتقد هناك حاجة قليلة إلى الرياضيات في فهم الدروس الأخرى.	غ ش	غ	ك	٢	ش
١٠- مواضيع الرياضيات تعتمد على النظريات والدروس النظرية.	غ ش	غ	ك	٢	ش
١١- إني أعتقد إذا كان لدي وقت كافي فأني سوف أكون قادر على فهم الرياضيات.	غ ش	غ	ك	٢	ش
١٢- الوقت المخصص للرياضيات كافي لحل جميع أمثلة وتمارين الكتاب المقرر.	غ ش	غ	ك	٢	ش
١٣- مواضيع الرياضيات مهمة جداً لحياتي طوال الدراسي.	غ ش	غ	ك	٢	ش

١٤- ني الصعوبه فهم لغه ورموز مواضيع الرياضيات. م ش ٣ ل غ غ ش

١٥- لفهم مواضيع الرياضيات، اني احتاج الى بذل جهد اكثر من بقيه المواضيع المدرسيه. م ش ٣ ل غ غ ش

١٦- الوقت المخصص للرياضيات في الجدول كافي لحل المسائل خارجيه. م ش ٣ ل غ غ ش

١٧- الرياضيات صعبه في الحصول على عمل جيد. م ش ٣ ل غ غ ش

١٨- معرفه الرياضيات هو المفتاح لمعرفة العالم في القرن العشرين. م ش ٣ ل غ غ ش

١٩- اكثر مواضيع الرياضيات فائدة تمكنه للتخرج. م ش ٣ ل غ غ ش

٢٠- انني اعتقد منهج الرياضيات يحتاج الى تعديل بعض المواضيع. م ش ٣ ل غ غ ش

APPENDIX F

The Hall-Jones Scale of Occupational Prestige

Source : Oppenheim (1966)

Class 1 : Professionally Qualified and High Aministrative.

Accountant
Analytical chemist
Architect
Army:
    Major and upwards
Auditor
Bank manager
Barrister
Civil Service:
    Administrative,
    C.E.O.'s, chief inspector of taxes,
    inspector of schools
Colleiery manager
Contractor (building, railway, etc.)
Dental (qualified)
Designer, aircraft
Diplomat
Director of Eduction
Doctor
Editor
Engineer (qualified)
Geologist
Headmaster (Sec. school or prep. school)
Insurance actuary
Land or farm agent or steward
Landowner
Marine surveyor
Medical Officer of health
M.P.
Navy:
    Lt. Cmdr. upwards
Planter
Police
    C/Suptd., D/Cdr., Cdr.,
    Ass/Commr., Chief Constable
Procurator fiscal
Quantity Surveyor
Race horse owner
Research scientist
Royal Air Force:
    Wing/Cdr. and upwards
Sheriff's substitute
Shipowner
Solicitor
Stockbroker
Sugar refiner
Surveyor (qualified)
Town Clerk
Treasurer, local authority
Underwriter, Lloyds
University lecturer
Valuation officer
Veterinary Surgeon (qualified)

Class 2 : Managerial and Executive (with some Responsibility for Directing and Initiating Policy).

Air pilot

    Captain and below
    (Commissioned)
Articled clerk
Bank clerk (Senior)
Chripodist

Civil Service:
    S.E.O.'s, inspector of taxes
    (higher grade); inspector of
    taxes
Commercial artist

Commercial Scientist
Density (unqualified)
Divisional Education Officer
Headmaster (elem. school)
Headmaster (indust. school)
Head postmaster
House property manager
Minister (nonconformist)
Navy: Leiut, and below Army:
(Commissioned)
Optician (qualified)
Patent agent
Personnel Manager
Pharmacist
Police:
Chief Inspector, Suptd.
Psychiatric social worker
Restauranteur
Royal Air Force:
Squadron leader and below
(Commissioned)
Sanitary engineer
Sanitary surveyor
Settlement warden
Teacher (sec. sch. or public
school)
Veterinary practitioner
(unqualified)

Class 3 : Inspectional, Supervisory, and Other Non-manual (Higher grade)

Advertising agent
Army:
W.O.
Bank clerk (junior)
Boarding out officer
Branch manager
Catering officer
Canal boat prioritor
Civil Service :
E.O.'s, Technical Oficer, Exptl.
Officer,
Collector, tax officer (higher grade)
Church Worker
Clerk of works
Club master (warden)
Colliery engineer
Commercial traveller
Committee clerk
Contractor
Dispensing Chemist (employed)
Dog breeder
Draughtsman (qualified)
Drug and food inspector (L.G.)
Entertainment organiser
Farm bailiff or grieve
Forwarding agent
Goods agent (railway)
Head Clerk
Horse breeder
Hotel Keeper or Manager
Industrial chemist
Inspector (insurance engineering)
Jockey
Journalist or reporter
Librarian (assistent, qualified)
Marine engineer
Mental health officer
Mental nurse (qualified)
Navy : W.O.
Overman, colliery
Permanent way inspector
Photographer
Physiotherapist
Police :
Inspector
Postmaster
Probation officer
Radiographer
Royal Air Force :
W.O.
Rate fixer
Rating Officer
Royal Marines
Sgt. Major, Q.M. Sgt.
Salesman
Sanitary inspector
Shorthand writer
Station master
Stockbroker's clerk
Teacher (elem.Sch., Jnr. teach.,
etc)
Technician (B.B.C.)
Undertaker
Youth employment officer
Youth organiser

Class 4 : Inspectional, Supervisory, and Other Non-manual (Lower Grade)

Accountant's clerk
Advertising Copywriter
Advertisement drawer
Army :
    Sgt. and S./Sgt.
Architect's apprentice
Auctioneer
Bank detective
Book Keeper
Butler
Chef or hotel cook
Chemical sampler
Civil Service :
    H.C.O.'s
    Assistance officer
Club leader
Coast guard Road
Costing Clerk
Cricketer (professional)
Customs officer
Deputy overman
Draughtsman (apprentice)
Erection engineer (unqualified)
Estimating clerk
Film cutter
Footballer (professional)
Furrier
Librarian (unqualified)
Licensed victualler
Market gardener
Masseur (employed)
Merchant navy:
    Radio Operator
    Cadet
    Midshipman
Navy :
    P.O. and C.P.O.
Police :
    Sergeant
Publican (inn keeper)
Radio officer (civil airways)
Royal Air Force:
    Sgt. and S/Sgt.
Safety Officer
Relieving officer
Religious brother
Sampler in brewery
School attendance officer
Shop supervisor
Shop walker
Signal inspector
Stationer
Sub-Postmaster
Surveyor's assistant
Toy designer

Class 5 : Routine Grades of Non-manual Work

Booking Clerk
Caretaker
Cashier :
    Box Office, Shop,
    Undefined
Civil Service :
    C.O.'s and T.C.'s,
    Asst. Collector,
    Tax officer
Clerk (routine)
Commissionaire
Dance band musician
Draughtsman (tracer-unqualified)
Hairdresser
Head porter
Librarian, assistant (unqualified)
Police :
    Constable, special
Post Officer clerk
Prison Officer (Warder)
Provident Collector
Railway detective
Rate Collector
Rent Collector
Sheriff's assistant
Shop assistant :
    Chemist, Confectioner,
    Draper, Florist, Grocer,
    Ironware, Furniture,
    Stationer, Tailor
Storekeeper
Telegraphist
Telephone operator
Waiter
Window dresser

Class 6 : Skilled Manual

Ambulance Man
Annealer
Apprentice (skilled trade)
Army :
Cpl. and LlCpl.
Baker
Blacksmith
Boiler maker
Boiler smith
Book binder
Book maker
Boot maker
Boot repairer
Brass moulder
Bricklayer
Builder (employed craftsman)
Bus driver
Butcher
Cab driver
Cabinet maker
Carpenter
Carpet weaver
Cap maker
Capstan setter
Caster (dies)
Chain maker
Cnarge hand
Chauffeur
Checker
Chimney sweep
Clicker
Cloth Lapper
Coach builder
Coach man
Colliery electrician
Colliery engineer
Colour mixer (if skilled)
Compositor
Concrete fencer
Cook
Cooper
Copper smith
Card wainer
Cotton weaver
Cowman
Crane driver
Currier
Cutler
Decoprator
Dental mechanic
Donkeyman (sea)
Dock gateman
Die-setter
Electrician (employed craftsman)
Engine stoker
Engineer (employed craftsman)
Engraver
Excavator driver
Farm worker (skilled)
Fitter
Forester
French polisher
Fur finisher
Furnaceman (chemical)
Galvanizer
Gamekeeper
Gauger
Gardener
Gas fitter
Glass blower
Glazier
Grainweigher
Groom
Gunsmith
Harness weaver
Head gardener
Horse dealer
Horseman
Hosiery timmer
Inspector (Gas Co., Transport etc)
Instrument maker
Ironmoulder
Iron or steel dresser
Iron driller
Jewes Cast maker
Joiner
Laboratory assistant
Landscape gardener
Lathe setter
Leather splitter
Lock gateman
Lodge keeper
Lorry driver (long distance)
Machine repairer
Maintenance fitter
Maltster
Marble polisher
Mason
Mechanic
Medical glass engraver
Merchant Navy :
Apprentice
Miller
Millwright
Mole catcher
Motorman
Motor engineer

Motor mechanic
Moulder
Musical instrument repairer
Navy :
Ldg. Seaman
Newsagent
Nurseryman
Operative (skilled)
Painter
Paint mixer
Paint sprayer
panel beater
Paviour
Pattern maker
Pit repairer
Plasterer
Plater (iron and steel)
Plumber
Portmanteau maker
Potter
Printer's cutter
Printer
Puddler (metals)
Quarryman
Radio mechanic (skilled)
Railway crossing keeper
Railway guard
Railway signalman
Range fitter
Record maker
Retort builder
Rivetter
Ropemaker
Royal Air Force :
Cpl. and LAC.
Sailmaker
Seedsman
Shepherd
Ship's plater
Ship's carpenter
Ship's fireman
Shipwright
Signwriter
Silk weaver
Silversmith (skilled craftsman)
Slater
Slaughterer
Slinger
Spinner
Stagehand
Steel cutter
Steeple-Jack
Stillman
Studgroom
Sweep
Talleyman (checker)
Tailor
Tanner
Teazer (glass)
Telegraph linesman
Thatcher
Tilemaker
Tinsmith
Toolmaker
Toolsetter
Toy maker (skilled)
Tractor driver
Turn cock
Turner
Upholsterer
Valve tester
Vulcanizer
Waggon examiner
Waggon painter
Watchmaker and repairer
Waterproof coat maker
Weaver
Welder
Wheelwright
Woodman
Wool/worsted spinner

Class 7 : Manual, Semi-Skilled

Agricultural worker, farm servant
Armature winder
Army:
Private
Artificial flower maker
Assembler
Baker's Assistant
Bargeman
Barman
Basketmaker
Billiard marker
Blacksmith's striker
Boilerman
Boot machinist
Brass bedstead maker
Brass wire worker
Brickmaker
Brushdrawer
Builder's scaffolder
Buttonhole cutter
Bus Conductor
Bucher's assistant
Canvasser
Capstan Operator
Carpenter's mate
Carpark attendant
Carpet finisher
Carter
Catering assistant
Closer
Cloth finisher
Coal conveyor
Coal Lewer
Coal trimmer
Core maker
Craneman (Crane driver)
Darner
Delivery man
Dental mechanic's assistant
Drayman
Driller (brush factory)
Dyer
Electrician's mate
Engineman
Farmworker (farm labourer)
File setter
Finisher (laundry)
Fisherman
Fitter's mate
Furniture remover (employee)
Garage hand
Gasmantle maker
Gown presser
Grain storeman
Grinder
Hall porter
Hammerman
Hand sewer
Holder-on
Hurdle maker
Ironer or clothes presser
Lathworker
Lighterman
Letter stamper
Lorry Driver (short distance)
Machine operator
Machinist
Maker (wooden-box)
Meter reader
Milkman
Muslin darner
Navy :
A.B.
Office boy
Operative (semi-skilled)
Ostler
Packer
Packing case maker
Pearl stringer
Pirn winder
Pit headman
Plastic Welder
Platelayer
Polisher
Porter (Town Hall)
Postman
Post office sorter
Presser (tailor's)
Printer's feeder
Railway engine cleaner
Railway linesman
Railway Porter
Roadsman
Rope slicer
Royal Air Force :
A.C.Z. and A.C.I.
Sawyer
Seaman
Serrator
Sexton
Sheet metal worker
Ship plater's helper
Shop Hand :
Greengrocer, Butcher, Fishmonger
Shunter
Stableman
Stevedore

Stoker
Storeman
Surfaceman (railway or road)
Switchman
Telegraph Boy
Ticket Collector
Tobacco spinner
Timber cutter
Tin pricker
Town porter
Traction engine driver
Trawlerman
Trimmer (coal, upholstery, etc.)
Van driver
Warehouseman
Warehouse worker
Wheeltapper
Wood machinist
Wool sorter

Class 8 : Manual, Routine

Bag sewer
Bath attendant
Bottler
Bottle washer
Boatman (canal)
Bolt screwer
Book folder
Boxmaker (cardboard)
Builder's labourer
Bundle maker
Cameraman (street)
Canteen assistant
Carman (shunter)
Carpet factory worker
Cattle drover
Cellarsman
Cleaner
Coal porter
Costermonger
Counterhand
Deal porter
Despatch labourer
Distillary worker
Docker
Drainer
Drain pipe layer
Errand Boy
Factory hand (routine)
Factory worker
Folder
Gasworker
Hawker (dealer)
Houseboy
Labourer
Lamp cleaner
Lamplighter
Lavatory attendant
Leather Carrier
Lift attendant
Loader
Lorryman
Machine minder (routine)
Messenger
Paper seller
Porter
Presshand
Publican's assistant
Quay labourer
Rabbvit seller
Railway yardman
Refuse collector
Roadman
Roadsweeper
Scavenger
Showcard mounter
Sorter (not p.o.)
Stacker
Street trader
Tar sprayer
Vanman

APPENDIX G

G-A : Details of Analysis of Variance of Attitudes Towards Mathematics (Questionnaire A).

Table G-A1: Analysis of variance for the enjoyment (ENJT) Sub-Scale of the pupils' attitudes towards mathematics, according to the pupils' sex and the schools' social class.

Source of Variation	Sum of squares	DF	F	Level of sig.
Sex	11.62	1	17.86	0.000**
SCHSOC	11.75	2	9.02	0.000**
SEX by SCHSOC	18.68	2	14.36	0.000**
Residual	236.21	363		
Total	278.54			

** Significant at 1% level

Table G-A2 : Analysis of variance for the easiest (EAST) sub-scale of the pupils' attitudes towards mathematics, according to the pupils' sex and the schools' social class.

Source of Variation	Sum of squares	DF	F	Level of sig.
Sex	3.58	1	8.87	0.003**
SCHSOC	6.84	2	8.47	0.000**
SEX by SCHSOC	4.11	2	5.08	0.007**
Residual	159.95	396		
Total	174.490			

** Significant at 1% level

Table G-A3 : Analysis of variance for the usefulness (USET) sub-scale of the pupils' attitudes towards mathematics, according to the pupils' sex and the schools' social class.

Source of Variation	Sum of squares	DF	F	Level of sig.
Sex	5.03	1	12.33	0.000**
SCHSOC	7.55	2	9.26	0.000**
SEX by SCHSOC	5.438	2	6.66	0.001**
Residual	159.803	392		
Total	178.442			

** Significant at 1% level

Table G-A4 : Analysis of variance for the importance (IMPT) sub-scale of the pupils' attitudes towards mathematics, according to the pupils sex and the schools' social class.

Source of Variation	Sum of squares	DF	F	Level of sig.
Sex	6.29	1	14.65	0.000**
SCHSOC	6.99	2	8.25	0.000**
SEX by SCHSOC	1.00	2	1.18	0.178^{ns}
Residual	164.308	388		
Total	179.850			

** Significant at 1% level
ns Not significant

Table G-A5 : Analysis of variance for the enjoyment (ENJT) sub-scale of the pupils' attitudes towards mathematics, according to the pupils' sex and occupation of Father.

Source of Variation	Sum of squares	DF	F	Level of sig.
Sex	10.82	1	15.65	0.000**
OCCFAT	7.82	2	5.66	0.004**
SEX by OCCFAT	2.08	2	1.50	0.223^{ns}
Residual	221.94	321		
Total	244.48			

** Significant at 1% level
^{ns} Not significant

Table G-A6 : Analysis of variance for the easiest (EAST) sub-scale of the pupils' attitudes towards mathematics, according to the pupils' sex and occupation of father.

Source of Variation	Sum of squares	DF	F	Level of sig.
Sex	2.65	1	6.68	0.010**
OCCFAT	6.01	2	7.57	0.001**
SEX by OCCFAT	0.318	2	0.40	0.671^{ns}
Residual	140.103	353		
Total	149.74			

** Significant at 1% level
^{ns} Not significant

Table G-A7 : Analysis of variance for the usefulness (USET) sub-scale of the pupils' attitudes towards mathematics, according to the pupils' sex and occupation of Father.

Source of Variation	Sum of squares	DF	F	Level of sig.
Sex	3.80	1	9.21	0.003**
OCCFAT	9.81	2	11.89	0.000**
SEX by OCCFAT	1.47	2	1.78	0.170^{ns}
Residual	143.89	349		
Total	159.84			

** Significant at 1% level
^{ns} Not significant

Table G-A8 : Analysis of variance for the importance (IMPT) sub-scale of the pupils' attitudes towards mathematics, according to the pupils' sex and occupation of Father.

Source of Variation	Sum of squares	DF	F	Level of sig.
Sex	4.24	1	10.21	0.002**
OCCFAT	5.67	2	6.82	0.001**
SEX by OCCFAT	0.40	2	0.48	0.616^{ns}
Residual	142.57	343		
Total	154.80			

** Significant at 1% level
^{ns} Not significant

Table G-A9 : Analysis of variance for the enjoyment (ENJT) sub-scale of the pupils' attitudes towards mathematics, according to their sex and Fathers' education.

Source of Variation	Sum of squares	DF	F	Level of sig.
Sex	11.61	1	16.19	0.000**
EDUFAT	2.74	3	1.27	0.282^{ns}
SEX by EDUFAT	5.03	3	2.34	0.073^{ns}
Residual	258.87	361		
Total	278.54			

** Significant at 1% level
ns Not significant

Table G-A10 : Analysis of variance for the easiness (EAST) sub-scale of the pupils' attitudes towards mathematics according to their sex and Fathers' education.

Source of Variation	Sum of squares	DF	F	Level of sig.
Sex	3.16	1	7.76	0.006**
EDUFAT	5.71	3	4.68	0.003**
SEX by EDUFAT	4.92	3	4.03	0.008**
Residual	160.26	394		
Total	174.49			

** Significant at 1% level

Table G-A11 : Analysis of variance for the usefulness (USET) sub-scale of the pupils' attitudes towards mathematics, according to their sex and Fathers' education.

Source of Variation	Sum of squares	DF	F	Level of sig.
Sex	4.75	1	11.50	0.001**
EDUFAT	8.49	3	6.84	0.000**
SEX by EDUFAT	3.06	3	2.47	0.061*
Residual	161.23	390		
Total	178.44			

** Significant at 1% level
* Significant at 5% level

Table G-A12 : Analysis of variance for the importance (IMPT) sub-scale of the pupils' attitudes towards mathematics, according to their sex and Fathers' education.

Source of Variation	Sum of squares	DF	F	Level of sig.
Sex	6.77	1	15.78	0.000**
EDUFAT	5.39	3	4.18	0.006**
SEX by EDUFAT	1.19	3	0.92	0.429^{ns}
Residual	165.72	386		
Total	179.85			

** Significant at 1% level
^{ns} Not significant

Table G-A13 : Analysis of variance for the enjoyment (ENJT) sub-scale of the pupils' attitudes towards mathematics, according to their sex and Mothers' Education.

Source of Variation	Sum of squares	DF	F	Level of sig.
Sex	11.39	1	16.15	0.000**
EDUMOT	3.35	3	1.58	0.192^{ns}
SEX by EDUMOT	8.83	3	4.17	0.006**
Residual	254.46	361		
Total	278.54			

** Significant at 1% level
* Significant at 5% level
^{ns} Not significant

Table G-A14 : Analysis of variance for the easiness (EAST) sub-scale of the pupils' attitudes towards mathematics, according to their sex and mothers' education.

Source of Variation	Sum of squares	DF	F	Level of sig.
Sex	3.13	1	7.45	0.007**
EDUMOT	4.27	3	3.38	0.018*
SEX by EDUMOT	1.04	3	0.83	0.477^{ns}
Residual	165.58	394		
Total	174.49			

** Significant at 1% level
* Significant at 5% level
^{ns} Not significant

Table G-A15 : Analysis of variance for the usefulness (USET) sub-scale of the pupils' attitudes towards mathematics, according to their sex and Mothers' education.

Source of Variation	Sum of squares	DF	F	Level of sig.
Sex	4.88	1	11.60	0.001**
EDUMOT	5.70	3	4.51	0.004**
SEX by EDUMOT	2.79	3	2.21	0.086^{ns}
Residual	164.29	390		
Total	178.44			

** Significant at 1% level
ns Not significant

Table G-16 : Analysis of variance for the importance (IMPT) sub-scale of the pupils' attitudes towards mathematics, according to their sex and Mothers' education.

Source of Variation	Sum of squares	DF	F	Level of sig.
Sex	6.13	1	14.05	0.000**
EDUMOT	2.46	3	1.88	0.132^{ns}
SEX by EDUMOT	1.47	3	1.12	0.339^{ns}
Residual	168.36	386		
Total	174.85			

** Significant at 1% level
ns Not significant

G-B : Details of Analysis of Variance of Teachers' Influence (Questionnaire B).

Table G-B1 : Analysis of variance of teachers' influence on pupils, according to their sex and the school social class.

Source of Variation	Sum of squares	DF	F	Level of sig.
Sex	669.931	1	9.50	0.002**
SCHSOC	5840.24	2	41.44	0.000**
SEX by SCHSOC	3611.127	2	25.62	0.000**
Residual	30298.36	430		
Total	40397.49			

** Significant at 1% level

Table G-B2 : Analysis of variance of teachers' influence on pupils according to their sex and Fathers' occupation.

Source of Variation	Sum of squares	DF	F	Level of sig.
Sex	489.74	1	5.42	0.020*
OCCFAT	420.05	2	2.32	0.099^{ns}
SEX by OCCFAT	899.35	2	4.97	0.007**
Residual	34606.95	383		
Total	36534.20			

** Significant at 1% level
* Significant at 5% level
^{ns} Not significant

Table G-B3 : Analysis of variance of teachers' influence on pupils, according to their sex and Fathers' education.

Source of Variation	Sum of squares	DF	F	Level of sig.
Sex	547.33	1	6.28	0.013*
EDUFAT	499.21	3	1.91	0.127^{ns}
SEX by EDUFAT	1962.67	3	7.50	0.000**
Residual	37287.86	428		
Total	40397.49			

** Significant at 1% level
* Significant at 5% level
^{ns} Not significant

Table G-B4 : Analysis of variance of teachers' influence on pupils, according to their sex and Mothers' education.

Source of Variation	Sum of squares	DF	F	Level of sig.
Sex	663.26	1	7.42	0.007**
EDUMOT	423.38	3	1.58	0.193^{ns}
SEX by EDUMOT	1105.27	3	4.12	0.007**
Residual	38221.08	428		
Total	40397.49			

** Significant at 1% level
^{ns} Not significant

G-E : Details of Analysis of Variance of Curriculum Influence (Questionnaire E).

Table G-El : Analysis of variance for the length (CURLEN) sub-scale of curriculum influence, according to their sex and school social class.

Source of Variation	Sum of squares	DF	F	Level of sig.
Sex	65.67	1	11.25	0.001**
SCHSOC	50.53	2	4.33	0.014*
SEX by SCHSOC	61.19	2	5.24	0.006**
Residual	2508.93	430		
Total	2689.95			

** Significant at 1% level
* Significant at 5% level.

Table G-E2 : Analysis of variance for the usefulness (CURUSE) sub-scale of curriculum influence, according to their sex and school social class.

Source of Variation	Sum of squares	DF	F	Level of sig.
Sex	466.43	1	37.60	0.000**
SCHSOC	45.36	2	1.82	0.162^{ns}
SEX by SCHSOC	24.98	2	1.07	0.366^{ns}
Residual	5333.35	430		
Total	5867.86			

** Significant at 1% level
ns Not significant.

Table G-E3 : Analysis of variance for the relevance (CURRLV) sub-scale of curriculum influence according to their sex and school social class.

Source of Variation	Sum of squares	DF	F	Level of sig.
Sex	68.64	1	6.02	0.015*
SCHSOC	326.05	2	14.30	0.000**
SEX by SCHSOC	5.79	2	0.25	0.776^{ns}
Residual	4900.45	430		
Total	5292.19			

** Significant at 1% level
* Significant at 5% level
ns Not significant

Table G-E4 : Analysis of variance for the difficulty (CURDIF) sub-scale of curriculum influence, according to their sex and school social class.

Source of Variation	Sum of squares	DF	F	Level of sig.
Sex	1036.43	1	66.87	0.000**
SCHSOC	946.56	2	30.53	0.000**
SEX by SCHSOC	444.72	2	14.34	0.000**
Residual	6663.89	430		
Total	9149.11			

** Significant at 1% level

Table G-E5 : Analysis of variance for the length (CURLEN) sub-scale of curriculum influence, according to their sex and Fathers' occupation.

Source of Variation	Sum of squares	DF	F	Level of sig.
Sex	57.38	1	9.28	0.002**
OCCFAT	62.47	2	5.05	0.007**
SEX by OCCFAT	24.00	2	1.94	0.145^{ns}
Residual	2368.22	383		
Total	2529.57			

** Significant at 1% level
^{ns} Not significant

Table G-E6 : Analysis of variance for the usefulness sub-scale of curriculum influence according to their sex and Fathers' occupation.

Source of Variation	Sum of squares	DF	F	Level of sig.
Sex	346.39	1	27.50	0.000**
OCCFAT	80.84	2	3.21	0.041*
SEX by OCCFAT	29.79	2	1.83	0.308^{ns}
Residual	4822.84	383		
Total	5337.64			

** Significant at 1% level
* Significant at 5% level
^{ns} Not significant

Table G-E7 : Analysis of variance for the relevance (CURRLV) sub-scale of curriculum influence, according to their sex and Fathers' occupation.

Source of Variation	Sum of squares	DF	F	Level of sig.
Sex	46.99	1	4.08	0.044*
OCCFAT	184.50	2	8.02	0.000**
SEX by OCCFAT	2.04	2	0.08	0.915^{ns}
Residual	4404.65	383		
Total	4662.37			

** Significant at 1% level
* Significant at 5% level
ns Not significant

Table G-E8 : Analysis of variance for the difficulty (CURDIF) sub-scale of curriculum influence, according to their sex and Fathers' occupation.

Source of Variation	Sum of squares	DF	F	Level of sig.
Sex	842.04	1	51.85	0.000**
OCCFAT	808.60	2	24.89	0.000**
SEX by OCCFAT	144.14	2	4.43	0.012*
Residual	6219.51	383		
Total	8201.03			

** Significant at 1% level
* Significant at 5% level.

Table G-E9 : Analysis of variance for the length (CURLEN) sub-scales of curriculum influence, according to their sex and Fathers' education.

Source of Variation	Sum of squares	DF	F	Level of sig.
Sex	69.17	1	11.61	0.001**
EDUFAT	36.65	3	2.05	0.106^{ns}
SEX by EDUFAT	34.95	3	1.95	0.126^{ns}
Residual	2549.06	428		
Total	2689.95			

** Significant at 1% level
ns Not significant

Table G-E10 : Analysis of variance for the usefulness (CURUSE) sub-scale of curriculum influence, according to their sex and Fathers' education.

Source of Variation	Sum of squares	DF	F	Level of sig.
Sex	459.17	1	37.07	0.000**
EDUFAT	46.59	3	1.25	0.290^{ns}
SEX by EDUFAT	55.59	3	1.49	0.215^{ns}
Residual	5301.51	428		
Total	5862.86			

** Significant at 1% level
ns Not significant

Table G-E11 : Analysis of variance for the relevance (CURRLV) sub-scale of curriculum influence, according to their sex and Fathers' education.

Source of Variation	Sum of squares	DF	F	Level of sig.
Sex	54.98	1	4.73	0.030*
EDUFAT	238.37	3	6.84	0.000**
SEX by EDUFAT	25.07	3	0.72	0.540^{ns}
Residual	4968.85	428		
Total	5292.19			

** Significant at 1% level
* Significant at 5% level
ns Not significant

Table G-E12 : Analysis of variance for the difficulty (CURDIF) sub-scale of curriculum influence, according to their sex and Fathers' education.

Source of Variation	Sum of squares	DF	F	Level of sig.
Sex	997.25	1	61.51	0.000**
EDUFAT	821.07	3	16.88	0.000**
SEX by EDUFAT	295.768	3	6.08	0.000**
Residual	6938.33	428		
Total	9149.11			

** Significant at 1% level

Table G-E13 : Analysis of variance for the length (CURLEN) sub-scale of curriculum influence, according to their sex and Mothers' education.

Source of Variation	Sum of squares	DF	F	Level of sig.
Sex	58.78	1	9.82	0.002**
EDUMOT	47.95	3	2.67	0.047*
SEX by EDUMOT	10.36	3	0.57	0.630^{ns}
Residual	2562.34	428		
Total	2689.95			

** Significant at 1% level
* Significant at 5% level
^{ns} Not significant

Table G-E14 : Analysis of variance for the usefulness (CURUSE) sub-scale of curriculum influence, according to their sex and Mothers' education.

Source of Variation	Sum of squares	DF	F	Level of sig.
Sex	392.16	1	31.67	0.000**
EDUMOT	66.69	3	1.79	0.147^{ns}
SEX by EDMOT	37.92	3	1.02	0.383^{ns}
Residual	5299.08	428		
Total	5867.86			

** Significant at 1% level
^{ns} Not significant

Table G-E15 : Analysis of variance for the relevance (CURRLV) sub-scale of curriculum influence, according to their sex and Mothers' education.

Source of Variation	Sum of squares	DF	F	Level of sig.
Sex	63.97	1	5.51	0.019*
EDUMOT	229.20	3	6.58	0.000**
SEX by EDUMOT	40.43	3	1.16	0.324^{ns}
Residual	4962.66	428		
Total	5292.19			

** Significant at 1% level
* Significant at 5% level
ns Not significant

Table G-E16 : Analysis of variance for the difficulty (CURDIF) sub-scale of curriculum influence, according to their sex and Mothers' education.

Source of Variation	Sum of squares	DF	F	Level of sig.
Sex	890.72	1	52.47	0.000**
EDUMOT	642.24	3	12.61	0.000**
SEX by EDUMOT	148.30	3	2.91	0.034*
Residual	7264.63	428		
Total	9149.11			

** Significant at 1% level
* Significant at 5% level

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