THE UNIVERSITY OF HULL

STUDENT, TEACHER AND HOME VARIABLES ASSOCIATED WITH STUDENTS' ATTITUDES TO AND ACHIEVEMENT IN SCIENCE IN THE THIRD YEAR OF INTERMEDIATE SCHOOLS OF SOUTHWESTERN SAUDI ARABIA.

Being a Thesis submitted for the Degree of

Doctor of Philosophy

in the University of Hull

BY

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June, 1994

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LIST OF ABBREVIATIONS

AM	Achievement Motivation
ATS	Attitude Towards School
ATSSA	Attitude Towards Science School Assessment
AMO	Self-achievement Motivation
CS	Classroom Size
ISSPQ	Integrated Science Student Perception Questionnaire
ME	Ministry of Education in Saudi Arabia
MED	Mother Educational Level
SAM	School Achievement Motivation
SATS	Student Attitude Towards Science
SHEQ	Student and Home Environment Questionnaire
SSCO	Science Self-concept
TCB	Teacher Classroom Behaviour
TPCB	Teacher Pre-classroom Behaviour
TQ	Teaching Qualification
TSH	Time Spent on Homework
TSRQ	Teacher and school Resources Questionnaire

SUMMARY

The purpose of this study is to explain the relationship between teacher, student and home variables and their relation to, attitude to and achievement in science in the third-year of intermediate boys' schools in Southwest Saudi Arabia.

The sample chosen comprised of 1129 students drawn from Seven Local Education Authorities, 25 schools and 60 classes, with 29 science teachers.

Six instruments were used to collect the research data: A carefully-constructed science achievement test was designed especially to assess student achievement in science. Previously developed questionnaires, namely, the ISSPQ, ATSSA, School Achievement Motivation were used. In addition, demographic data were obtained from students and teachers. The data were submitted to SPSS program for various analyses, including descriptive and product moment correlation.

Teacher was the unit of analysis in which 29 teachers' means for every variable was calculated.

The findings reveal that integrated science teachers tended to show reasonable positive classroom behaviour in all items of Teacher Pre-classroom Behaviour and Teacher Classroom Behaviour.

The correlation analysis revealed that negative correlation was found between teacher's qualification and student science achievement. Positive significant correlation existed between teacher variables of Teaching Experience, Teacher Pre-classroom Behaviour, Teacher Classroom Behaviour and Student Attitudes Towards Science.

Positive correlations were also found between School Achievement Motivation and Student Attitude Towards Science.

Significant positive correlation was found between Teacher Classroom Behaviour Variables and student variable of School Achievement Motivation was also found.

There was positive significant correlation between Time Spent on Homework and student variables of School Achievement Motivation and home variables of Mother's Education and Occupation, as well as with the study outcomes of attitude towards science.

In view of the low correlations by some variables investigated, and in order to provide more evidence for or against the results obtained, it is recommended that further research is necessary using different methods, and that other variables be included in future research.

ACKNOWLEDGEMENT

I would like to express my sincere gratitude to my supervisor Dr. J.L. Moore of the Science Education Centre, Hull University, not only for reading and correcting the drafts of this thesis, but also for his advice and constant encouragement throughout the period of his supervision. It has indeed been a joy to work with someone so dedicated and supportive.

I am also grateful to the Ministry of Education, Local Education Authorities Directors and Supervisors, for giving me the opportunity to undertake the study and for their help and encouragement.

My sincere gratitude also goes to Dr. A. Saied, Mr.Abdellah Burak, Mr. Ibrahim Jubran, Mr. Saieg, for their comments and suggestions about the achievement test and the other research questionnaires.

My thanks, also, go to Dr. A. Al-shahrani of the Department of Curriculum and Instruction at College of Education, Abha Saudi Arabia for his scientific help.

I also thank the following people Mr. A. Shakh Mr. M. Omar and Mr. O. Areef for being very helpful.

I would also like to thank "all members of my family" and friends for allowing me to be away from them to finish this research.

INTRODUCTION

Developing countries of the world, in their attempts to achieve modernity and promote industrialization, have placed a heavy emphasis on science-based education. This emphasis, they hope, will instil in their young people scientific knowledge and favourable attitudes towards the use of science.

The generally accepted and desirable consequences of education include increased achievement and improved attitudes. These outcomes have been shown to be interrelated (Steinkamp and Maehr 1983).

An individual's science achievement and attitude towards science can be influenced by many factors. Three groups of factors, which have been the focus of much investigation, are Teacher variables, Student variables and Home variables.

Many studies have been undertaken in an effort to identify the main determinants of academic achievement and attitudes in science.

Both school and non-school variables have been shown to have some influence on science achievement and attitude (Bridge, Judd & Moock, 1979; Centra & Potter 1980; Glassman & Biniaminove, 1981; Kremer & Walberg, 1981).

There is substantial evidence that *Teachers* do make a difference to student performance, attitude formation and aspirations, especially in developing countries (Brophy and Good 1986, Husen et. al. 1978). There is no doubt about the crucial part that teachers play in the learning process. In fact, teachers in our societies are given great trust and confidence by both parents and education authorities to teach and take over the responsibility for educating new generations. It is obviously true that the teacher's active presence in the classroom promotes the learning process, and that if there is no teacher present, there is often little learning and schooling taking place, particularly at the primary and secondary-school levels. Therefore, teachers have a very important influence on students' attitudes and achievements which must be taken into account. Extensive analyses of teacher behaviours have been carried out by Rosenshine (1971) and Avench et al. (1974). Rosenshine, examining 51 studies from U.S, U.K and Australia, suggested that some teacher variables, particularly those relating to classroom interaction, were directly related to students' performance. There was little support (Bloom, 1976), however, for believing that some characteristics of a teacher (e.g, age, length and type of pre-service training, amount of experience, and teacher attitude), or such classroom and school variables as the number of students, equipment and facilities available, have much effect on the learning of students.

Heyneman (1976) has argued that the determinants of school achievement in less developed countries are different from those in the developed countries. Saha (1983), referring to two reviews of school achievement in less developed countries, namely, Husen et. al., (1978) and Heyneman (1976), indicated that the pattern of independent research findings was not consistent with those in the developed societies. They showed that in less developed countries, school and teacher variables, particularly the latter, have considerable effect on differences in student academic achievement.

In general, the cumulative evidence indicates that better trained and more experienced teachers produce higher academic achievement in students. Bloom (1976) suggested that there ought to be a shift in focus from status input characteristics (presage variables) to process-oriented ones where school variables are clearly identified. It is the teaching and not the teacher that is central and it is the teaching behaviour in the classroom rather than the physical characteristics of the class and classroom that is important for school learning (Bloom, 1976).

Teaching as a job confers great responsibility on the teacher for the welfare of individual students who are taking part in the education process. In fact, teaching as a job is described as unique by Tamir and

Amir (1987). On the one hand, teachers are regarded as essential for the survival of modern knowledge and our technology-based society; on the other hand, only a few of the best minds of society are attracted to teaching.

Therefore, research on classroom behaviours is important. As Keeve (1975) put it, 'it is the interaction of teacher, student and materials which constitute the curriculum'. This interaction, in which actual teacher classroom behaviours constitute an important part (Keeve, 1975), should be assessed as a whole. Further, Centra and Potter (1980) suggested that more research in teaching behaviour is needed.

Student background, perceptions of instruction, and student attitudes have all been shown to correlate to some degree with achievement (Schibeci, 1986).

Several investigators have reported positive relationships between student self-perception and cognitive and non-cognitive learning outcomes (Bloom, 1976: Kremer & Walberg, 1981; Simpson & Troost, 1982; and Urgulou & Walberg, 1979). Haladyna, Olsen, and Shaugnessy (1982) suggest that there is " powerful evidence" that student attitude towards science is linked to a positive perception of self and the ability to learn. It seems that students, who have a strong positive regard for their own abilities to learn, have a more positive attitude towards and achieve better in science.

Developing positive attitudes towards science has been an espoused goal of most of the curriculum development efforts since the late 1950s (Welch, 1979) and sometimes it has been regarded as equally important as cognitive development (Shulman & Tamir, 1973).

Moyer (1975), also, recommended that attitudes should be studied in relation to multiple variables.

Talton & Simpson (1986) identified three categories of variables: self-concept, home environment and school environment, which seem to play important roles in determining students' attitudes towards science.

In "Human Characteristics and School Learning", Bloom (1976) suggested that attitudes towards science may be part of a larger and more powerful attitude system: attitude towards school, which, in turn, may be part of an even larger system, which he called academic self-concept. He went on to speculate that academic self-concept is part of a student's general self-concept.

Despite the fact that attitudes towards science have been studied for quite a long time, and hundreds of studies have been conducted and reviewed (Gardner, 1975; and Schibeci 1984) the debate is still alive. Not only this, but investigators have been trying to improve instrumentation and methods of analysing attitude measures. Munby (1983) criticised measures of attitude towards science as being often immature and inadequate. The major problem, according to Gardner (1975), Schibeci

(1983, 1984), Munby (1983a, 1983b), and Blosser (1984), is that the attitude instruments are of poor psychometric quality. Most measures do not provide appropriate psychometric evidence of reliability and validity.

In fact, recent research has examined attitude in relation to other important variables. Such variables may be endogenous as they are related directly to school or are under the influence of the school process, for example, teaching behaviour, or exogenous located outside the influence of the institution of schooling, for example, race of the students (Haladyna & Shaugnessy, 1982). Other studies have investigated the attitude of students towards science as a major aim in itself rather than in relation to other important variables.

The need to study the relationships among variables having potential impact on students' science achievement has been expressed throughout science education literature. Good (1972) suggested that research needs to focus on the relationships among personality factors, beliefs and attitudes. Okey and Yeany (1978), in a national study on science education research, found that investigations seeking relationships among student variables were priority areas.

In fact, it is the endogenous variables that offer the most potential for improving attitudes by such means as new curicula, better teaching and more practical-science experiences. It should be admitted that negative attitudes and low achievement are undesirable outcomes which could be attributed to the inherent difficulty of science, the way in which it is taught by the teacher, the person who teaches the subject, the atmosphere in which it is taught, the curriculum, or merely part of a maturing process among children. More likely it is a combination of these and other factors.

Germann (1988) argued that significant parts of any learning event are thinking, feeling, and acting; what some investigators call the cognitive, affective, and connotive domains. He also argued that the manner in which the subject is taught, in which the curriculum is presented, and in which the classroom activities are conducted are a result of the knowledge, world views, belief system, life goals, lifestyle, needs, skills, and attitudes that the teacher brings to the classroom. The learning environment, or milieu, is the product of this interaction of learner, teacher, and curriculum.

Common to a large number of studies is the consistent finding that the student's home background is an important determinant of the level of achievement. The contributions of home and school factors to science achievement seem to vary and are very much a function of the level of economic development of the country in which achievement is measured. In one of the largest international studies, the IEA study (Comber and Keeves, 1973), school factors showed only minimal effects on science achievement.

Previous research has identified a consistent relationship between certain background measures such as family size, socio-economic status and student learning (Wiley & Harnichfeger, 1974; Walberg & Rasher, 1979).

All the above mentioned studies have indicated the important of these variables in raising student achievement and attitude and have an effect in mediating the effect of other variables.

Hence this study arises and the influence of three groups of variables (Teacher, Student and Home) on three dependent groups of variables (Student Perceptions of Science Instruction, Student Attitudes and Student Science Achievement will be examined.

STRUCTURE OF THIS THESIS

This study describes a preliminary attempt to examine in a comprehensive manner, the extent to which a large number of student, teacher and home variables are associated with both attitude to and achievement in science. It is the first attempt to explore such associations among boys and their science teachers in Saudi Arabian intermediate schools. The data were collected from third-year students studying general science in grade nine, aged 15+ years; also, for the first time, students perceptions' of a wide range of their teachers' classroom behaviours are used in such a study.

Teacher variables include general information from teachers on personal details such as their education, teaching experience, age, etc.,. These represent the "presage" variables selected for the study. Other teacher's variables were collected from their students who were asked to express their perceptions of their science teachers in relation to their Pre-Classroom Behaviour, Classroom Behaviour, Classroom Personality and Classroom Attitudes. These represent the teacher classroom or "process" variables.

Student variables were collected using appropriate questions in which students provide information about themselves including their age and race. Other instruments are used to collect student Attitudes Towards

School, Science Self-concept and Self-Achievement Motivation. Moreover, students are asked to report, in hours, the time they spend doing their daily homework.

Home variables are explored using four closed-type questions to be answered by the student by choosing one category from several alternatives related to mother's education and occupation and to father's education and occupation as well as family size. In addition, an instrument is used to study student Attitudes Towards Science. This variable, along with achievement is one of the "product" or "outcome" variables used in this study. Furthermore, this study uses a science achievement test constructed to this research to assess student science knowledge of part of the science syllabus to which students are exposed towards the end of their intermediate-school course. Hence, the thesis is divided into seven chapters.

Chapter One: deals with Saudi Educational System, Curriculum Promotion, Teacher Provision and Teacher Evaluation

Chapter Two: deals with A Statement of the Research Problem and suggested way of looking at this problem and suggested model to be investigated.

Chapter Three: literature reviews of previous research on teacher, student and home variables chosen in this study.

Chapter Four: discusses the research design and methodology which are used to collect data and research proposals.

Chapter Five: results of the pilot studies of the selected instruments, report of the validity and reliability measures of these instruments and statistical procedures.

Chapter Six: sampling and report of the main results of the study.

Chapter Seven: discussion of the results of the main study; conclusions, limitations and recommendations.

In this study it is assumed that certain independent variables such as students' perceptions of their science teacher (pre-classroom behaviour, classroom teaching behaviour, classroom personality and classroom attitudes), students' attitudes to school, achievement motivation and science self-concept and some home measures can be used to predict both students' attitudes to science and achievement in science. These two latter variables are regarded as the dependent variables in this study.

CHAPTER ONE

BACKGROUND TO THE STUDY

1.0 INTRODUCTION

Education is the key to a nation's progress. It prepares individuals to be good citizens and to strive for an ideal society. Improved education plays a vital part in the development of any country . It is rare to find a developed society which does not place a strong emphasis on education. Saudi Arabia has taken this principle for granted and has moved towards developing educational establishments leading to growth in many such fields as industry, technology and social welfare.

Accomplishment and improvement in education and in other fields have taken place, not only as a result of a real determination on the part of the government and the Saudi people, but also because of the country's wealth which comes from oil exports.

As a result of its rapid development and progress, Saudi Arabia, like other developing nations, needs skills and qualified manpower in the scientific and technical fields. Therefore, the general aims of education in Saudi Arabia are to eradicate illiteracy and to prepare scientifically and technologically trained people, who need the basic facts, concepts, and abilities to apply scientific processes in daily life. A further main objective of education in Saudi Arabia is to train technicians, teachers, managers, and administrators who are desperately needed to cope with rapid economic development.

1.1 SAUDI ARABIA: SYSTEM OF EDUCATION

Education in Saudi Arabia is made available to all who wish to attend but is not compulsory at any level. It consists of six years of elementary, three years of intermediate and three years of secondary education. The last level was, for a time, changed so as to be operated on a credit hours system whereby the student is required to complete successfully 168 hours within three or more years. However, this system was abandoned in 1991 in favour of a return to the normal secondary-school system.

Education for males and females is completely separate in terms of administration, facilities, and instruction. However, curriculum and textbooks, prescribed by the central authorities at all levels, are unified throughout the kingdom for both sexes. The Ministry of Education supervises public education, and inspectors in each district maintain the quality of education and administration through personal visits to the schools.

As a demonstration of its total commitment to education, the Saudi government covers the cost of education at all levels; from village schools to major universities, for those who qualify. Students at certain levels are provided with a monthly stipend to encourage them to pursue their education.

Most educational institutions are run by the government. The private sector plays a complementary role, but its total contribution is quite small compared with that of the public sector. Private education at the elementary to secondary levels operates under the direct supervision of the Ministry of Education for males and the General Administration For Girls' Education (GAGE) for the females. The curriculum in these schools must conform to the curriculum prescribed in the public system, although additional subjects may be offered.

There are several international schools in Saudi Arabia, some following the American curriculum. Only non-Muslem students may attend these schools, since no instruction in Islamic studies is offered.

1.1.0 FORMAL EDUCATION

Formal education in Saudi Arabia is provided by two different organisations:

1. The Ministry of Education (boys' schools only)
2. The General Administration of Girls' Education (girls' schools)

1.1.0.1 THE MINISTRY OF EDUCATION:

The rise in school enrolment is reflected in the changes in the socio-economic conditions of the country. These changes have continued to take place at rapid pace and, in 1978-79, nearly 25 years after its establishment, the Ministry of Education operated 6,580 schools with a total enrolment of 758,614 male students at predominantly the elementary, intermediate, and secondary stages. This number accounted for nearly 57 percent of the total student body in the country (Ministry of Education Data Centre, 1980).

1.1.0.2 THE GENERAL ADMINISTRATION OF GIRLS' EDUCATION (GAGE):

This organization was established in 1960. Objections from concerned parents and ulama (religious scholars) to girls' schools, based on the fear that such modern schools might have undesirable effects on girls, delayed until this time the government's establishment of these schools. Girls' schools were put under the ulama's administration and were, thus, independent of the Ministry of Education. In its first year, GAGE opened 16 schools. Less than 20 years later, in 1979-80, GAGE operated 2,644 schools, mostly elementary, intermediate and secondary with a total enrolment of 425,042 female students. At that time students made up 32% of the total student body in the country (Saudi Arabia, Ministry of Education, Centre for Statistical Data 1980).

1.1.1 NON-FORMAL EDUCATION

This includes adult education, which is given much attention by the government in general, particularly by the Ministry of Education and the General Administration of Girls' Education. The main purpose of adult education in Saudi Arabia is the eradication of illiteracy. Between 70 and 80 percent of Saudi adults of 15 years of age and older were estimated, in 1982, to be illiterate, a reduction from the UNESCO 1962 estimate of 97.5 percent. While illiteracy eradication is a goal in itself for some, the majority of adult students probably enrol in order either to obtain the basic literacy requirements of private and government employers or to improve their chances of promotion with such employers. Skill training is not an objective of adult education in Saudi Arabia except in a small number of private and government women's schools where programmes to teach typing, tailoring and other skills are becoming increasingly popular among women, who want to join an increasingly speciality-oriented job market.

1.1.2 THE MAIN STAGES OF SCHOOLING IN SAUDI ARABIA.

The following section outlines the main stages of schooling in Saudi Arabia which are structurally the same for males and females at the pre-college levels.

1.1.2.1 ELEMENTARY SCHOOL

Elementary education in Saudi Arabia lasts for six years. The curriculum at this stage is divided into two parts. From year one to year three the curriculum emphasises the basic skills of reading, writing and arithmetic. From the fourth year to the sixth year the curriculum is based on Arabic, Islamic studies, history, geography, mathematics and physical education. Final examinations are administered at the end of each academic year and students must pass tests in all subjects before being promoted to the next grade. A "pass" in the final examination at the end of the sixth year (at age 12 or 13 years) completes the requirements for the General Elementary School Certificate. Formerly, sixth-year students sat for an external examination set and marked by the Ministry of Education, but in 1978 this system was changed in favour of examinations set and marked by the local education authorities throughout the country. In 1981, schools were given the responsibility to set and mark the examinations. This means that students are not examined externally during the elementary stage.

1.1.2.2 INTERMEDIATE SCHOOL

This is a three-year (beginning at 12+ years) period which prepares students to continue on to general secondary schools, nursing training, commercial, communication and technical or other secondary schools and institutions which prepare students for various forms of employment.

Subjects studied at the intermediate level include Arabic language, Islamic studies, English language, mathematics, history and geography, general science, industrial arts and physical education. The grading system is similar to that at the primary level. Final examinations are administered at the end of each year and those who pass the exams at the end of the third intermediate year are awarded the Intermediate Education Certificate. As was the case with Elementary schools, this period was formerly assessed by examinations set and corrected by the Ministry of Education but, in 1981, a change was made so that examinations were set and corrected by the local education authorities throughout the country. Finally it was left to the school to set the examinations and correct them. Thus, students are not examined externally at the age of 15+ years. Some students may enter other institutions to be trained for a specific job, while still having some difficulty in basic skills.

1.1.2.3 SECONDARY SCHOOL

Secondary education is also a three year period in Saudi Arabia. Options at this level include general secondary school, teacher training programmes, and technical and vocational training. General secondary schools are attended by the most academically qualified students. During the first year, both boys and girls follow similar curriculum, although girls do not participate in physical education and they must take home economics, needlework and child care.

At the end of the first year, students are divided into scientific and literary sections. Students must attain a grade of at least 60 percent in all first year subjects in order to qualify for the scientific section, where the curriculum includes Arabic language, Islamic studies, English language, algebra, statistics, geometry, physics, chemistry, biology and geology (earth science). In 1983 the mathematics curriculum was replaced with modern mathematics. The literary section curriculum includes Arabic language, Islamic studies, English language, geography, history, sociology and psychology. At the end of the third year, students sit for the national General Secondary Examination, which contributes 70 percent of the final score for the General Secondary Certificate. The remaining 30 percent is determined by classroom performance.

Teacher training institutes at the secondary level offer programmes designed to train elementary school teachers. Women are trained in women's Teacher Training Institutes, while men are trained in the Institutes for Training Elementary Teachers. The programmes in both cases last three years. Teacher training for the elementary level will be upgraded gradually so that junior colleges will replace the existing secondary level training institutes.

Technical and vocational training programmes are also options for male secondary students.

1.2 CURRICULUM DEVELOPMENT AND TEACHING METHODOLOGY

With little prior expertise in modern education, the educational system in Saudi Arabia basically adopted the Egyptian school curriculum, adding a heavier emphasis on religious subjects. The curriculum of boys' and girls' schools is identical.

Both the Ministry of Education and GAGE have a curriculum department, although little has changed in their educational programmes since their inception. Both organizations hire the authors of the required textbooks, print the books, and distribute them among their schools. Thus, there is a uniform curriculum in the country. The general composition of this curriculum is shown in Table 1.

All schools in Saudi Arabia whether operated by the Ministry of Education or GAGE, follow curicula guidelines laid down centrally. Normally, these prescribe content and pedagogical structure.

Table 1

Subject Areas and Weekly Hours of Classroom Study Assigned to Students in the Elementary, Intermediate and Secondary School System:

SCHOOL	ELEMENTARY		INTERMEDIATE	SECONDARY	
SCHOOL SUBJECT	FIRST GRADE	SIXTH GRADE	NINTH GRADE	TWELFTH GRADE Sci.	Art
Religious studies	12	9	8	4	4
Arabic subject	9	9	6	2	11
Social Sc. History/ Geography	-	3	4	-	8
Mathemat.	4	6	5	9	-
Science	2	4	4	12	-
Drawing	3	2	2	-	-
Physical education	2	2	1	1	1
English Language	-	-	6	6	6
Total	32	35	36	35	30

Science in intermediate schools is "nature-study" oriented and largely descriptive. It is structured so as to be taught in an integrated manner and includes topics in chemistry, physics, biology, environment, astronomy, earth science and technology throughout all the three years of this level. Science at this stage occupies 11% of the timetable.

At the secondary level, the sciences are taught in the science stream throughout as separate subjects: chemistry, physics, biology and earth science. Science accounts for about 33% of the curriculum time as shown in Table 1.

Teaching methods differ from subject to subject. Teachers of religious subjects emphasize memorization of religious texts and rarely use any teaching aids other than the blackboard. Teachers of Arabic use the blackboard and, also, require a fair amount of text memorization. Teachers of science subjects use laboratories when they are available in their schools. Most schools' laboratories, however, are deficient either in equipment or in qualified personnel, or in both.

Arabic is the language of instruction throughout the elementary, intermediate, and secondary levels. At college, Arabic is the medium in the arts, humanities, and social sciences. English is the medium of instruction in engineering, medicine and the natural sciences.

There is a scarcity of college level textbooks in Arabic, and college instructors who use Arabic often type up their own notes and use them as basic required texts. The result is a shallowness in educational standards in some college departments.

1.3 EXAMINATIONS, PROMOTION AND CERTIFICATION

In grades 1 to 12, the school year is divided into two semesters. The required instructional material for a year is divided into two halves. At the end of each semester, there is an examination that covers one half. The student's marks in the two semesters are added up to make up his or her total mark for the whole year. If the final mark is below a certain percentage, usually 50 percent, the student fails in that subject and sits another examination in the subject at the end of the summer vacation. If the student fails again to attain the required minimum mark, he/she has then to repeat the whole year, retaking all the subjects of that year, including those already passed. Success in passing examinations constitutes the only criterion for promotion from one year or grade to the next.

Colleges operate on a semester basis but, in a number of universities, the credit-unit system has been adopted and thus students who fail a particular subject do not have to repeat the whole year or semester but rather only the subject they failed, if it is a required one. This system is shared by women's institutions at all educational levels from elementary school to university or college.

1.4 SUPPLY OF TEACHERS

Having a qualified teacher in each of the nation's classrooms is essential for achieving scientific and technological literacy. The qualifications of Saudi teachers have improved over the years. In their early years, the Ministry of Education and GAGE often hired teachers who possessed no qualification other than being literate. Over the last 15 years, there has been an increase in the numbers of trained Saudi teachers at all levels of schooling.

To provide the expanding elementary-school system with the teachers they needed, elementary teacher-preparation institutes were built. These institutes offered a two-year programme after elementary school. They were later upgraded to provide three years of teacher training after the intermediate school and now provide most of the Saudi teachers at the elementary level.

As far as science teachers in the elementary school are concerned, most have no specialised knowledge in any subject, science or otherwise, because the majority of them have come from a three-year secondary school teacher training programme.

Intermediate and secondary-school teachers are predominantly four-year college graduates, although more and more Saudi teachers at the intermediate level may come from the newly established science and mathematics centres. In 1975, Saudi teachers occupied less than one-third of the teaching positions at the intermediate level. During the academic year 1987-1988, national teachers amounted to about 52% of the teaching staff at this level. There are now nine four-year colleges of education in the country (four for males and five for females), which in addition to training teachers for the intermediate and secondary schools, also, occasionally offer in-service training to school teachers and principals.

There are several different ways of becoming an intermediate or secondary teacher. These are:

1. Four-year university-level programmes (usually leading to a Bachelor of Science or Arts degree) taken at university.

2. Four-year course leading to 'Bachelor of Education and Science' (or Arts) taken at a College of Education. This involves considerable emphasis on science, mathematics, English, history, geography, religious education or physical education as a study in its own right. Prospective science teachers specialise in chemistry, biology, or physics. Students also take some courses in psychology, education and methods of teaching their subject, and undertake teaching practice at intermediate schools.

3. Four-year course at one of the science and mathematics centres which were mainly established to

overcome the shortage of science and mathematics teachers for the intermediate school level and to provide in-service training for those who would like to improve their teaching qualification. Such institutes have very high entrance requirements, which include examinations in the sciences and mathematics. Comparatively few students attend them.

4. Two-year college teacher training, which is also designed to provide in-service training to teachers within the elementary school and to enhance their teaching. These institutes are widely available throughout the country. There are separate institutes for men and women. They provide courses in the sciences and mathematics, new teaching methodology and education.

5. Four-year course at the College for Islamic and Arabic languages.

This means that most teachers in elementary and intermediate schools have no degree in the subject they teach. Although the aim of having more Saudi teachers has been achieved to a certain extent for some subjects, according to most recent official documents (Educational Documentation 1989), as shown in Table 2 which also shows that the percentage is lower, little is known about the effectiveness of these teachers. Indeed, they are often subject to some criticism by parents and the media (Iqraa, 1990).

Table 2

The Percentages of Saudi Teachers in the Intermediate and Secondary School in 1988.

School Subject	Intermediate School	Secondary School *
Social Science	78.7	70.2
Religious Studies	59.5	48.9
Sciences	54.2	18.7
English Language	44.3	16.4
Mathematics	35.3	12.9
Arabic Language	26.5	11.4

*. Source: A Semi-Annual Bulletin Issued by Centre for Statistical Data & Educational Documentation Issue No. 30, 1989.

Teachers are accused of being unqualified and failing to make lessons attractive to students. Moreover, of the many routes to employment as a teacher, not all offer specialised educationally-orientated programmes, i.e., students being able to continue their own academic education rather than training to undertake teaching as a profession.

1.5 TEACHERS' EVALUATION IN SAUDI ARABIAN SCHOOLS

Evaluation of teachers in Saudi Arabian schools is based upon visits to schools by the local education authority's supervisors and headteachers of schools. Supervisors claim to visit their allocated teachers twice a year. These evaluations are supplemented by headteachers' reports. This means that little is known about teachers in general and science teachers in particular. In the eyes of some people too little is known about their children's teachers. Students are not effectively engaged in the evaluation of their teachers, although they are the only people who see their teachers every day and engage with them in many activities. Their evaluation of their teachers could be a major contributor to the latters' success.

Some supervisors and teachers might see the evaluation of teachers by their students as a sensitive issue which could have a deleterious side effect on teacher-student relationships. However, in their two visits, supervisors may be unable to witness a sufficient range of activities. Thus, many teachers' behaviours and skills will remain unknown to the evaluator. There is clear evidence that we should not depend exclusively on ratings by trained observers in evaluating classroom events (Veldman & Peck, 1967). Anderson & Walberg (1974) confirmed that no matter how highly trained an observer is, he is only a single judge, who knows very little about actual classroom events and is likely to be less sensitive to what is important in a particular class. Students and teachers interact with each other on a daily basis and students and thereby, become familiar with teachers' skills, traits and attitudes (al-Methen & Wilkinson, 1986; Shingles, 1977). Waxman & Duschi (1987) claimed that the use of students' perceptions as predictors of general effectiveness of teachers yielded slightly stronger results than the use of observer ratings. Also, of course, teaching behaviour is of more consequence to pupils than to others because as Watson (1963) stated

> **it is the pupil who is doing the learning, his image of the teacher is the real and important image.**

Some educators believe that students lack the proper perspective to evaluate their teachers' classroom behaviour. There is the danger that other variables such as subject matter, sex, class size, grades received from teachers, age of pupil and so forth, may affect students' perceptions of teachers (Patton & Meyer, 1955; Aleamoni & Hexner, 1980). Such objections have been disproved by a number of researches (Veldman & Peck, 1967; Aleamoni & Yimer, 1973; Subkoviah & Leven, 1974; Centra, 1970; Hayes et al., 1967) which compared the honesty and reliability of students' perceptions of their teachers. Cohen (1981), who undertook a meta-analysis of findings of 41 previous studies, found that an average correlation of 0.43 between students' ratings of instructors and students' examination performance was stronger and more consistent than the separate findings of previous studies. Also, students appeared to be able to perceive the same sort of teaching behaviours as more experienced expert observers (Denton et al., 1977). Rushton & Murray (1985), for example, stated that

> **students rating of classroom teaching also correlated 0.50 to 0.90 with comparable ratings made by supervisors, colleagues, alumni and paid observers indicating that students' perceptions of good and poor teaching are similar to those of more expert, more mature and more neutral observers.**

CHAPTER TWO

RESEARCH PROBLEM, MODEL FOR THIS STUDY AND METHODS USED TO INVESTIGATE THESE VARIABLES

2.1 RESEARCH PROBLEM

Saudi Arabia is a country which has developed rapidly and much change has occurred within a short time in many fields, including education. In Saudi Arabia, public concern about the weakness of learning among Saudi students has been expressed in the local mass media from time to time but, unfortunately, little effort has been made to investigate educational aspects (Al-Baadi 1985).

In recent years, there has been considerable debate about the poor achievement of students, particularly within intermediate and secondary schools (Eqraa, 1990). Three main sets of factors are likely to be responsible for such a situation and these are identified with the teacher, student and home variables.

Teachers in Saudi Arabian intermediate and secondary schools have been strongly criticised as being weak, lacking variety in their teaching approaches and insufficiently prepared academically in the subjects they teach in school. In addition, teachers have little talent and ability for teaching, as they often cannot understand the content of lessons they are teaching, are not trained to present lessons in an appropriate manner, and do not make lessons interesting and understandable for students (Eqraa, 1990). Therefore, such a lack of professional and academic preparation could seriously damage the teacher-pupil relationship and lead to negative attitudes and poor achievement in any subject matter. In fact, the lack of student achievement in science in any country in the world could be attributed to many factors related to the structure of the science curriculum, the lack of qualified teachers and technicians, and the lack of scientific materials such as scientific books in the native language. This is particularly the case in developing countries. The problem of low achievement among Saudi students, which has been widespread for some time, is quite common in science, mathematics and English. A major aim of the Ministry of Education in Saudi Arabia has been to prepare native teachers, especially for intermediate and secondary school (Al-Baadi, 1985), to alleviate the problem of shortage of teachers. It is hard, however, to find talented, motivated and committed teachers.

The performance at school of an individual student is likely to be influenced by dispositions, attitudes and values held by the student attitudes towards different aspects of school and school learning.

As far as the Saudi Arabian students are concerned, teachers claim that students nowadays do not put sufficient effort into what they learn at school, and have a poor attitude towards school and learning school subjects.

Parents have an important role to play, but most families are not aware of the relationship between schools and home. Many of them are unable to help in terms of monitoring their children's academic process until it is too late. Because of the low levels of formal education of parents in developing countries, one would expect the school effects on such outcomes as science motivation and achievement to outweigh the home influence.

Many school head teachers and teachers blame the family for contributing little to following-up their children's achievement, e.g, by visiting schools and asking about their children's problems. According to one of the Saudi Local Education Authority directors, who spoke to the researcher during the present research fieldwork, very few parents (fathers) turn up when there is a school parents' meeting. Although schools send monthly reports to children's parents about their children's learning development, little move is made from the home towards collaboration to solve problems at an early stage, according to some LEA directors, supervisors and headteachers met during the field work.

Parents often criticise teachers for their children's poor results. Students, also, have responsibility for their own learning: following the lesson, asking questions, and working hard both at school and at home, in order to understand the topics being taught.

These broad claims about the shortcomings of teachers, students and home have been made generally without any strong empirical research data to substantiate them. In one educational outcome at least there is, however, evidence that schools are not providing the desired effect. Al-shargi (1987) has shown that Saudi students have negative attitudes towards science and that they achieve lower than non-Saudi students in grades 10, 11, and 12 (16, 17, and 18 year-old students) in science subjects.

The literature review shows no research undertaken in the field of education in Saudi Arabia regarding achievement and attitudes in intermediate school science, in relation to such variables as teacher effectiveness, academic self-concept, achievement motivation, and home environment. The researcher considers that there is a particular need to assess students' achievement in grade 9 (15+ years of age). As already stated in chapter one regarding the stages of the Saudi Educational system little is known about student achievement and attitude in this particular year, since the Ministry of Education abandoned external examinations for this age group in 1986. However, it is an important time for decisions, as it is the year in which most students transfer from general schools to other institutions, or leave for early employment. Few of those who go to the general secondary school choose science as their major interest.

A further aim is that this study results from a recommendation made by Al-shahrani (1989), who examined some relationships between student, teacher and school variables associated with students' achievement in biology in secondary schools of Southwest region of Saudi Arabia. He found that the cognitive variables of competence in mathematics and Arabic language were significantly correlated with success in biology. Mathematical ability was the best predictor of biology achievement, accounting for 32% of the variance. Parental education of both the mother and father and father's occupation were also significantly correlated with achievement. Student interest in science accounted for an additional 13% of the variance in achievement. Teacher characteristics such as their level of interest in biology, lower teaching load and sufficient planning time were also positively correlated with biology achievement. Only one school variable was related to achievement. Al-shahrani recommended that similar studies are needed at other educational levels in the same region to confirm and extend these findings.

For this reasons, the current research aims to study student achievement and attitude in science in relation to variables such as students' perceptions of the behaviour of their science teachers, science teachers' age, years of teaching experience, teaching qualification, science teaching load, students' academic self-concepts, attitudes towards school and science, students' Self-achievement motivation, student's family variables (socio-economic status, and family size).

The aim is to identify the extent of the contributions of these variables to both student achievement and attitude to science.

Such findings could establish whether or not these claims about teachers and students are true, as students' outcomes are the most important criteria in measuring successful teachers. The study also presents an opportunity to identify some of the characteristics of effective science teachers and about students themselves and the influence of homes.

2.2 MODEL FOR THIS STUDY

Haladyna et al (1982) identified **exogenous variables** as those located outside the institution of schooling and are not under the direct influence of the schooling process. Examples of exogenous variables include the age of a student, race, socio-economic status and the family size. For teachers the exogenous variables include the age of a teacher, teaching experience, qualification and race.

Endogenous variables are those which are under the influence of the school process (Haladyna et al, 1982) and may have a direct or indirect influence on attitude to and achievement in science for example teacher pre-classroom behaviour or teacher classroom behaviour.

In this study the exogenous variables will be related to both teacher will include age, teaching experience teaching qualification and race, student's exogenous variables include age, race socio-economic status of the parents (parents educational and occupational levels) and family size. Some of these variables have been investigated and relationships between them and schooling outcomes were found (Schibeci, 1989, Haladyna et al 1982).

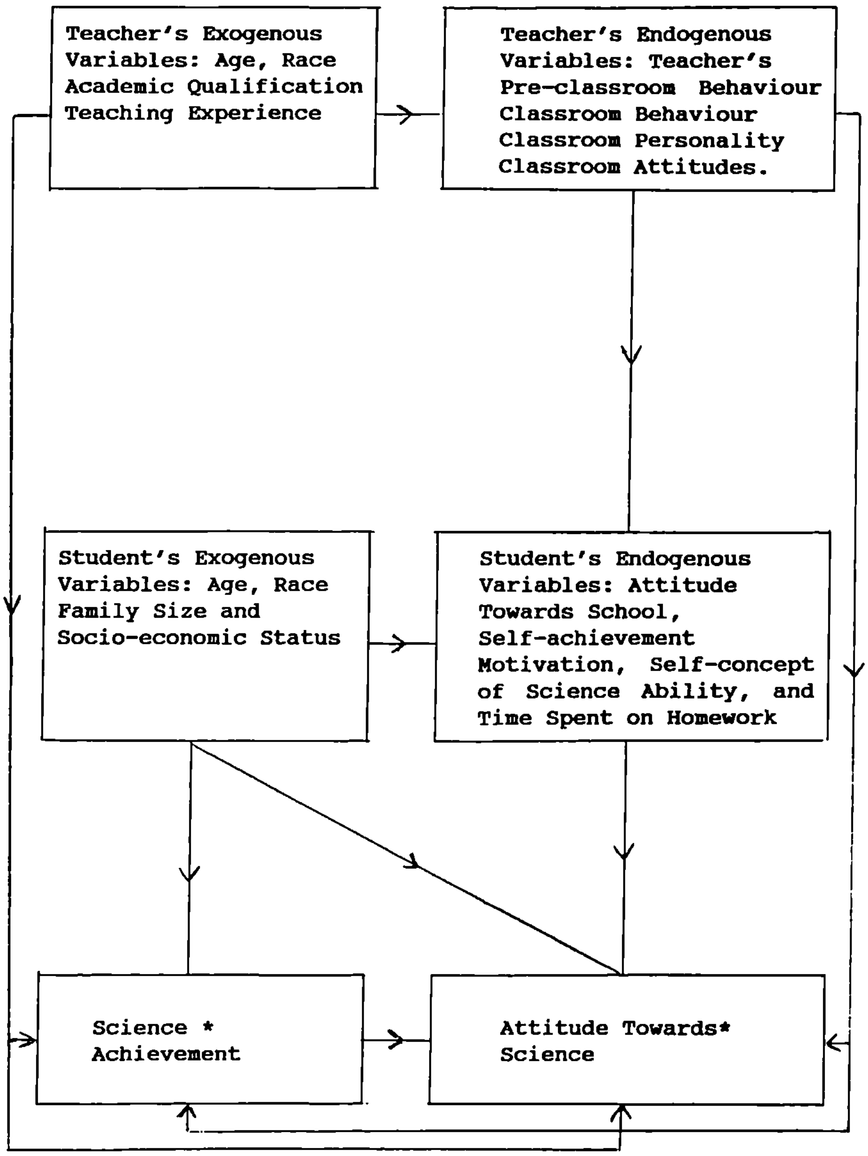
The endogenous variables for teacher might have a relationship with student attitude to and achievement in science, these might include teachers' pre-classroom characteristics. These characteristics are divided into items including, teachers science knowledge, laboratory material collection and laboratory presentation.

Teaching behaviour includes items associated with teacher pupil communication (e.g, questioning, oral interaction and use of non-verbal material), communication and reinforcement, communication and laboratory activities, communication and classroom management, control and discipline, classroom management, classroom management and reinforcement, reinforcement. Teacher personality which include items related to personality characteristics directly, social relations with pupils, teacher professionalism; attitudes to teaching, personality and communication, personality and classroom management and control. These characteristics have been identified as important for teacher to possess in order to have an effective pattern of behaviour and therefore good schooling outcomes as will be demonstrated in the literature review of chapter three.

Student endogenous variables include attitude towards school, self-concept of achievement motivation, self-concept of academic ability and time spent on homework which have been found to have an influence in schooling outcomes as will be demonstrated in the literature review of chapter three.

Therefore the following model will be investigated.

Model For This Study



* Outcome Variables

2.3 METHODS USED TO INVESTIGATE TEACHER BEHAVIOUR AND SOME OTHER VARIABLES ASSOCIATED TO STUDENT, TEACHER AND HOME.

In the past decades there have been many attempts aimed at finding key teacher characteristics consistently associated with student outcomes, regardless of subject area, context, grade level, or gender of student (Saha, 1983, Henyman, 1978). For the most part, research workers have looked simply for the existence of a direct relationship between counts of teacher behaviour on the one hand, and classroom achievement gain on the other (Biddle & Duncan, 1974, Cohen, 1981).

Techniques for gathering classroom behaviour data may be indirect (e.g., **student perceptions**, simulated recall), or direct (**live observation**) and may or may not involve the permanent storage of events (specimen records, audio or video recordings).

In recent years considerable research has been undertaken on measuring teacher classroom performance using student perception or ratings (Cohen, 1981).

In support of the use of student perception instruments it has been shown that student ratings of their teachers have considerable validity (Cohen, 1981).

2.3.1 TEACHING BEHAVIOUR

For decades, science inspectors and methods lecturers have used rating scales to make judgments about the effectiveness of teachers.

a) Observation

The direct observation of teacher behaviour in the classroom has become an important element in current educational research methodology as indicated by the findings that have been revealed (Flander, 1970; Galton, 1979).

There are many observation techniques used in looking at teacher teaching behaviour. The following section will describe the techniques used:

Check-list: A list of expected behaviours is prepared and every time the behaviour occurs during the specified observation time unit, the observer enters a tally mark next to the appropriate category. The time unit is usually in terms of seconds; for example scan the room for 30 seconds and record it; five minutes later, scan the room and record again.

Rating Scales: rating scales require the observer to watch the focus of the observation for a specified period of time. The period of time to observe may vary from five minutes to 60 minutes. At the end of the time, the observer rates the prevalence of certain behaviours during the period on a scale.

Interactive Coding Systems: these allow an observer to record everything a teacher or a student says or does during a given time span. The time is usually several five-minute intervals spaced evenly throughout a class period.

Narrative Description: this technique involves writing in narrative form everything observed that is relevant to the focus and purpose of the observation. Although some technical terms may be useful and desirable, for the most part, the terms used to describe the observed phenomena are the observers natural words.

Recent researchers have developed similar systems that enable teachers and researchers to report on a variety of classroom interactions. The essential characteristics of all these systems are that they involve the presence of an observer in the classroom, the recording of events in a systematic way as they happen and the coding of the interactions in such a way as to make possible a subsequent analysis of teacher and pupil behaviour.

One of most widely known observation systems used in science is the Science Teaching Observation Schedule developed by Galton and Eggleston (1979). The STOS uses categories specifically focusing on the intellectual transactions that take place during teacher-pupil interaction. In a study of 94 science classes, Galton and Eggleston were able to describe the nature of teacher-pupil interaction as well as the styles of teaching adopted by teachers.

The observation systems are very time consuming and require considerable commitment to train a number of reliable observers to research in a number of schools.

One final point to be added to the argument against using the observation system is that observers, even they are non-participant in a classroom situation, can affect teachers lesson plans and behaviour simply by being present in the classroom.

b) Student Perceptions of Teachers

Although investigations into the opinions and perceptions of teachers hold a prominent place in educational research, how students perceive their teachers and the opinions they hold of them have tended to be ignored by research. It has been suggested that this may be so because there is a general belief that what pupils think and feel can be manipulated by teachers, the implication being that how they perceive the teacher is largely under his control (Taylor, 1962).

This belief is only partly true, however, and there are at least two possible reasons why students' perceptions and opinions should be regarded as important and accorded a central place in educational research. First, if we recognise, as Nash (1974) has suggested, that teachers' expectations for their students have an effect on their students' behaviour, then we should similarly recognise the reciprocal hypothesis that students' expectations for their teachers might equally have an effect on their teachers' behaviour. Second, Thompson (1975) notes that concern is continuously being voiced about the increasing alienation of students from their schools, and that a search being made for the sorts of changes to the education system which will make schools more relevant and satisfying to the needs of the current generation of school children. Such changes, it is argued, would lead to a population more sympathetic towards the educational system and more successful within it. It is, therefore, relevant, Thompson concludes, to examine how pupils feel about school and teachers in an attempt to discover the appropriate directions of change.

Student perception of teachers' classroom behaviour is a more dynamic transactional perspective method in which student thought processes are being examined as sources of influence in the teaching-learning process (Wittrock, 1986).

As mentioned in Chapter One the students perceptions of their teachers' classroom behaviour were found to be reliable and stable (Cohen, 1981).

Recent years have shown considerable interests in looking at teacher classroom behaviour using student perceptions or ratings of teachers' classroom behaviour since they are the one who interact with teacher for a longer period and for various activities (Cohen, 1981; Al-methen & Wilkinson, 1986, Tairab & Wilkinson, 1991; Jegede, 1989).

2.3.2 METHODS USED TO INVESTIGATE THE OTHER VARIABLES OF TEACHERS AND STUDENTS

In addition to teachers' variables this study also includes some variables related to students which allow different methods of data collections to be used. First by direct questions for demographic data or using more systematic systems to collect data on attitudes, perceptions and interests.

Allpert identified three essential features of attitudes: (a) perception or readiness for favourable or unfavourable responses, (b) organised through experience, and (c) activated in the presence of all objects and situations with which the attitude is related.

Measurement of Attitudes.

Attempts to measure attitude require the making of inferences about attitude from some observable indicator. The categories can be formed on the basis of the type of indicator on which the inference is made. One of the methods that enable inferences to be made is based on individuals' responses to a series of sentences or objectives. Methods falling into this method are called scaling techniques and the instruments developed are called scales.

The most prevalent means of measuring attitudes is providing individuals with a list of sentences or adjectives and asking them to respond to each sentence or adjective in accordance with their true feelings. As has been mentioned previously these lists are called scales. The most frequently used scales are (1) **Thurstone scales**, the individual expresses agreement or disagreement with a serious of statements about the attitude object. (2) **Likert scales**, the individual checks one of five possible responses to each statement; strongly agree, agree, undecided, disagree, strongly disagree. (3) **Semantic Differential scales**, the individual gives a quantitive rating of an attitude object on a variety of bipolar adjectives, such as fair-unfair, valuable-worthless, and good-bad. (4) **Gutman scales, interviews, and open-ended questionnaires** are examples of other methods used to measure attitudes.

Although other scaling technique have been developed since 1952, Likert and the Semantic Differential types continue to enjoy the greatest popularity.

Teacher, student and home demographic data could be obtained by using an interview where interviewees are asked previously prepared questions. These questions are collected by taping the answers or writing them by the interviewers. Another way of collecting these data could be by using paper and pencil which is less time consuming and cheaper way of obtaining data which require direct answer from individuals for closed questions.

CHAPTER THREE

REVIEW OF LITERATURE ON CHOSEN VARIABLES

3.0 INTRODUCTION

This literature review is based on information obtained from the Education Resources Information Centre (ERIC), the Bath Information Data Service (BIDS), the American Dissertation Abstract, British Index for Theses and Dissertations and The International Encyclopedias (e.g., International Encyclopedia for Teacher and Teaching Education, International Encyclopedia for System of Education). In addition to these sources, the researcher used Saudi Arabian libraries to collect further information of relevance to the present study.

As discussed in Chapter 2 the model used for the research includes a large number of variables related to teacher and student-home which may or may not predict schooling outcomes of attitude to and achievement in science.

For teachers' variables the literature review included variables of age, race, qualification, teaching experience, for the grades (more than or lower than the 9th grade) assigned for this study. Although not all of the studies were related to science, it was also, useful to report research in other subjects such as mathematics.

Some variables might not be included in this literature review because of the limited number of researches undertaken. For example, the lack of extensive researches on classroom size, teaching load and student age, could be attributed to the fact that researchers might have been convinced that these variables have a negative direction especially with the first two variables. These additional variables will be discussed in the context of findings revealed in a later chapter.

3.1 TEACHER'S VARIABLES

3.1.0 INTRODUCTION

The effect of schooling on the individual pupil depends to a considerable extent on who is his teacher. To study the characteristics of teachers, researchers have looked at three types of data. These are:

1. Presage variables, which may be relevant to classroom behaviour such as the teacher's experience and qualifications, and environmental variables.

2. Process variables, which characterise teachers' and students' behaviour within the classroom.

3. Product variables, which are measures of outcomes such as achievement and attitudes.

1. Education degree (Presage);
2. Teacher teaching experience (Presage); and
3. Teacher teaching behaviour (Process)

The presage variables, which have been studied, include age, sex, years of teaching experience in specific subject area and in-service training undertaken as well as qualification(s) possessed. It could be useful to study teachers' sex and the differences in their classroom performance, but the existence of single sex school system in Saudi Arabia made it unnecessary to undertake such comparison.

3.1.1 TEACHING QUALIFICATION

A considerable body of research findings has grown up to support the contention that, on balance, the better the qualifications of a teacher, the better the student performance.

Winser (1978), reviewing the literature for a study of teacher qualifications as predictors of student achievement in mathematics, concluded that qualifications are positively related to student performance across a broad range of studies, although the relationships are neither uniform nor consistent.

Ponder (1977) found correlations of .79 and .73 between levels of teacher qualification and grade-equivalent composite scores for students at the grade 4 and grade 8 levels (age nine and 13 years old pupils) on the Canadian Tests of Basic Skills in the school districts of Newfoundland and Labrador.

Fagan and Ponder (1981) investigated the relationship of certain teacher characteristics included general qualification area of training with the achievement of high school students. Data were collected from all grade eleven students (approximately 8,000) in Newfoundland in Canada. The achievement test was measured by the school average score on the grade eleven public examination. The results indicated that the level of teacher qualification was significantly related to achievement (r=0.19).

In their review of more than 20 studies of this variable in USA, Glasman and Biniaminov (1981) concluded that variables, such as education degree were positively related to students' reading and mathematics achievement.

It seems that not many studies have been undertaken to study science teacher qualification in relation to student science achievement. This could be attributed to the fact that a limited number of teachers especially in primary level possess science teaching qualification and science achievement is difficult to assess because it comprises many activities and skills.

3.1.1.1 SUMMARY:

It is very difficult to reach a generalisation about the effect of teacher qualification on student achievement because of the limited studies conducted in this area as shown in Table 3.

It is worth, to conduct this variable in Saudi Arabia schools since there was no study has been undertaken to correlate teaching qualification and science achievement, perhaps because teacher qualification varies very greatly and it is only recently that Saudi teachers have filled a large percentages in school teaching (Al-baadi, 1985).

Table 3

Summary of findings of the Correlation between Teacher Teaching Qualification and Student Achievement.

Author	Date	Sample	Subject	Country	Correlation
Ponder	1977	Grade 4 Grade 9	Basic Skills	Canada	0.79 0.73
Fagan & Ponder	1981	8,000 Grade 11	General	Canada	0.19
Glas-sman & Bini-aminov	1981	20 Studies	Meta-A	USA	+ve

3.1.2 TEACHER TEACHING EXPERIENCE

This section is devoted to search for findings related to teacher's teaching experience. In this part any findings related to any school subject will be reported.

Alexander and Simon (1975) concluded that an experienced teacher has a greater impact on students' performance in primary and junior secondary schools than an inexperienced teacher.

Beebout (1978) conducted a study in Malaysia involving 87 schools and 7674 pupils in which he studied the relationship between teachers' experience and student performance in language and mathematics. A significant correlation was observed between the two variables. Carnoy (1978) showed a similar relationship in a sample of 182,000 pupils from primary schools in Puerto Rico. He further demonstrated that teacher experience seems to be crucial for imparting skills and knowledge in pupils' early years.

In Kenya, Thias and Carnoy (1978) concluded that a teacher's experience was a better predictor than any other teacher variable of students' performance in primary-seven examinations.

In a study mentioned previously, Fagan and Ponder (1981) found a positive correlation between general school achievement and teacher's teaching experience ($r=0.17$).

Tuntufye & Bernadette (1989) investigated the relationship between teachers' characteristics such as sex and teaching experience and pupils' academic achievement. Their sample consisted of 2559 pupils in primary schools in Botswana (1517 girls and 1042 boys), and 662 teachers (578 women and 84 men). Their results showed that pupils taught by experienced teachers performed significantly better than pupils taught by teachers with short teaching experience. This was the case not only in the pupils' overall performance, but also in individual subjects, such as mathematics, English, science and social studies, $t=12.5$, $p=0.001$, $t=10.4$, $p=0.001$, $t=10.9$, $p=0.001$ and $t=13.5$, $p=0.001$ respectively.

Keys (1987) investigated the relationship between length of teaching experience and student achievement in science among a sample covering 10 year-olds to A-level students in the UK. Key found that length of teaching experience was positively correlated with students' science achievement particularly with student achievement at A-Level.

Sandra et. al. (1986) investigated factors contributing to achievement in physics of secondary students in Mississippi schools in USA. A sample of 616 physics students and 91 physics teachers participated in this study. Among the findings a positive significant correlation was found between the number of years of teaching experience in physics and students' physics achievement (0.30).

In a study mentioned previously Glasman and Biniaminov (1981) concluded from their review of more than 20 studies in the USA, that teaching experience was positively related to students' reading and mathematics achievement.

Bruce (1987) summarised the results of 23 studies for the possible relationships between teaching experience of the teacher and students' achievement from the third world countries. The findings revealed no correlation between teaching experience and achievement in 13 studies, which means that only 10 significant correlations were found between teaching experience and student achievement.

In their synthesis of education productivity research Fraser et al. (1987) found positive small correlation (0.10) between teaching experience and student science achievement.

This section indicates a difference in the teaching experience effect between the third world in which it was found that teaching experience has little effect on student learning compared with the positive effect of teaching experience in developed countries like USA. This could be attributed to the shortage in the facilities, equipments and more likely to the size of the classrooms where teachers may have little chance to show their experience.

3.1.2.1 SUMMARY

Findings of previous research concerned with the associations between teacher factor of teaching experience and student outcomes suggests that any associations which may exist are not very strong (Keys, 1987) as also shown in Table 4.

Although studies which have examined the relationship between teaching experience and student achievement in general have found only weak correlations, a slight trend in favour of older or more experienced teachers can be discerned.

Having looked at the previous studies related to teacher's teaching qualification and teacher teaching experience in relation to student achievement, it is worthwhile to study the result of this qualification and the experience in the classroom level, in other words how teachers behave in the classroom and the effect of these behaviours in student outcomes.

Table 4

Summary of findings of the correlation between Teacher Teaching Experience and Student Achievement.

Author	Date	Sample	Subject	Coun.	Correl.
Fagan & Ponder	1981	8,000	General	Cana	0.17
Tuntufye Bernadett	1989 2559	Primary	Math Engl Scie S.s	Bots-wana	t=12.5 t=10.4 t=10.9 t=13.5
Sandra et. al.	1986	616	Physics	USA	0.30
Key	1987	10 year A-level	Science	U.K	+ve
Glassman & Biniam-inov	1981	20 Studies	Meta-A	USA	+ve
Bruce	1987	23 Studies	Meta-A	Third World	+ve 10 Studie
Fraser et. al.	1987	Synthesi	Meta-A	World	0.10

3.2.1 TEACHER TEACHING BEHAVIOUR

This part is devoted to reports of studies related to teacher teaching behaviour in a variety of subjects and using different methods of data collection, whether by direct observation or by asking students to rate teachers or classroom related behaviour. Such studies have been conducted world-wide, for example Jegede, (1989) from Nigeria, Almethen and Wilkinson (1986) in Kuwait.

The aim of including this part in this thesis is to look at teacher teaching behaviour in Saudi Arabia where no such study was previously undertaken in large scale. Almethen and Wilkinson (1986) studied students' perceptions of their science teachers' classroom behaviour, personality traits and attitudes in Kuwait using a sample of 210 students from secondary schools. They found that Kuwaiti students' perceptions of their science teachers corresponded very closely with findings of other research studies which attempted to use student ratings to measure teacher characteristics and behaviour in other classrooms and institutions.

Jegede (1989) studied students' perceptions of their science teachers among sample of 2110 Nigerian integrated science students (1145 boys and 965 girls). He found that students are capable of assessing their teachers regarding how effective their science teaching is, and they can also determine the characteristics that make an effective teacher. The results showed that science teachers in Nigeria are perceived by students as possessing a mixture of positive characteristics (competent, humorous, asks questions frequently, keen in what they teach, fair to all, etc.) and negative ones (do not allow students to experiment on their own, do not use homework for diagnosis, regurgitate fact, do not present inquiry-based lessons, etc.) in terms of the overall perception of students.

Yager and Penick (1984) reported an investigation of science teacher characteristics from a sample of 2500 students. They found that only 42% of 13 year olds and 44% of 17 year olds thought they were encouraged to state their own opinions, while 68% of 13 year olds and 67% of 17 year olds perceived that their science teachers encouraged them to think for themselves. Furthermore, only 19% of 13 year olds and 22% of 17 year olds considered that their science teachers took a personal interest in them. In addition, about 80% of both 13 and 17 year olds perceived their science teachers as liking science. The percentage of teachers regarded as enthusiastic did not reach more than 60% of both age groups. Moreover, only about 50% of teachers, for both age groups, appeared to make science exciting.

When researchers were persuaded of the reliability, validity and stability of students' perceptions, a large number of studies were conducted to identify the behaviour of teachers in science and other subjects by using students' ratings.

It is one of this study's purposes to explore the correlation between teacher teaching behaviour and student science achievement, therefore it is useful to look at what previous studies found in the correlation between teacher teaching behaviour and student achievement in general and science in particular. This what the next part will be highlighting.

3.2.2 RELATIONSHIP BETWEEN TEACHER TEACHING BEHAVIOUR AND STUDENT ACHIEVEMENT.

This part reports studies related to teacher instruction behaviour and student achievement.

Teacher classroom instructional behaviour has been the concern of many researches as Wittrock (1986) pointed out. Achievement is maximized when teachers not only actively present material, but also structure it by beginning with an overview, advance organizers, or review of the learning objective; outlining the content and signaling transitions between lesson parts; calling attention to the main ideas; summarizing subparts of the lesson as it proceeds; and reviewing main ideas at the end. Clarity of presentation is a consistent correlate of achievement, and students learn more from clear presentations than from unclear ones.

As mentioned in Chapter Two, researches have looked at teacher behaviour using two different methods: Observation and student rating. Although students' perceptions of their teachers' instruction behaviour is the method which will be used in this study, it is worthwhile to report some other studies related to teacher instructional behaviour.

Follman (1974) investigated the relationships between student ratings of instructor and achievement. He found positive relationships between student ratings of teacher's instruction and achievement; a correlation of about 0.40 across all school levels- was found between students ratings of teacher's instruction and their achievement.

Kulik and Kulik (1974) studied the relationships between student ratings of their teachers and student achievement. They found inconsistency of results with a median correlation of 0.27 (adjusted) and 0.23 (unadjusted) for overall rating.

Centra (1979) also investigated the correlation between student ratings and student achievement. The results indicated a significant positive relationship between student ratings and achievement.

Doyle (1979) and Marsh (1980) obtained similar low to moderate correlations between student ratings and student achievement.

Mintzes (1977) found weak positive correlation coefficients, between student ratings of their instructors and their achievement, averaging 0.20 to 0.30.

Centra and Potter (1980) investigated a model for the relationship between student rating of teacher instruction and student achievement. They found that teaching performance correlated significantly with changes in learning, were different by subject matter and by grade level, and that no single skill or teaching performance was found to be equally effective in both 2nd and 5th grade or in both reading and mathematics instruction. They also, found that no single teaching-performance variable which correlated so highly with student achievement that it should be considered critical for effective teaching.

Cohen (1981) meta analysed the correlation between student ratings and student achievement. He found a positive correlation between the students ratings of their teachers and student achievement (r=0.43).

Menis (1988) explored the relationship between teaching behaviours and student performance on the "proportion" concept in biology, chemistry, and physics classes in upper secondary-level schools in Canada. He used a sample of 224 schools and 9416 upper secondary-level students (5261 male, 4155 female). Central to his study was the behaviour of teachers as reported by students who responded to a 24-item instrument assessing teachers' instructional behaviours. Also measured was student understanding of the "proportion" concept using 14 items relating to topics in biology, chemistry, and physics. Students' performance and students' estimates of the frequency of teaching behaviours displayed in the science classroom were analysed. High achievers were prone to assess highly those teachers who use their own ideas in planning, use demonstration to explain science, make science interesting, encourage students to copy the teacher's notes, emphasise relevancy of science to life, discuss science careers, and help and encourage students to arrive at their own solutions to laboratory or field problems. Achievement in the "proportion" concept, concluded Menis, seems to be related to teacher behaviours as measured by students' perception of their teachers instruction.

Tairab (1992) studied the relationship between students' perceptions of their biology teachers and student achievement. A sample of 564 Sudanese students from third-year of secondary school, 14 schools and 41 biology teachers participated in this study. Tairab found positive correlations of 0.17-0.36 between student perceptions of their biology teachers' classroom behaviour and students' biology achievement. Teacher behaviour variables accounted for 8.1% of the variance in boys biology achievement.

3.2.2.1 SUMMARY

Although some might expect the correlation between teachers classroom behaviour and student achievement to be high this is not usually found.

Table 5

Summary of findings of the correlations between Teacher's Teaching Behaviour and Student Achievement.

Author	Date	Sample	Subject	Country	Correlation
Kulik & Kulik	1974		General	USA	0.27
Centra	1979	*	General	USA	+ve
Doyle	1979	*	General	USA	+ve, L.M
Menise	1980	*	General	USA	+ve, L.M
Centra & Potter	1980	*	General	USA	+ve
Mintzes	1977	*	General	USA	0.20-0.30
Menis	1988	9416	Physics	Canada	+ve
Tairab	1992	564	Biology	Sudane	0.17-0.36
Cohen	1981	Meta-A	General	M-A	0.43

It is clear from Table 5 that significant correlations of 0.17-0.43 between teacher teaching behaviour and student achievement do exist but that this correlation is sometimes weak and small enough to be ignored. This uncertainty in the research findings could be related to the difficulty of including all teacher classroom behaviours to be assessed.

3.2.3 RELATIONSHIP BETWEEN TEACHER TEACHING BEHAVIOUR AND STUDENT ATTITUDE TOWARDS SCIENCE.

Research in this area is very limited and if there are such studies they are mainly relating teacher teaching behaviour and students' attitudes towards science.

This part is devoted to reporting the relationship between student perception of teacher teaching behaviour and student attitudes towards science as an outcome of schooling.

Rainey (1978) studied the relationship between science teachers' verbal and non-verbal behaviours and students' attitudes towards science classes and teachers, in middle school (age 12-13) classrooms in USA. The experiment involved 16 teachers and about 360 students. Student attitudes towards science were measured twice with a questionnaire over a six-week period. The IDER (Indirect/ Direct; Encouraging/Restricting) system was used to classify the teachers' verbal and non-verbal behaviour. The results showed that there was no significant relationships between teachers' behaviour patterns and students' attitudes.

McMillan and May (1979) used a semi-structured interview to collect data from a random sample of pupils from a junior high school in suburban Denver consisting of 7th, 8th and 9th grade students (N=53). The data were analysed by frequency of responses; among the conclusions reached included the fact that the pupils mentioned the interrelationships of teachers with students, as crucial variables in attitude formation. Thus, they pointed out, that the teacher must assume a large part of both the responsibility and challenge of developing positive attitudes towards science.

More enjoyment of physics was found to be associated significantly with students' perceptions of the science teacher as well-organized, intellectual, ambitious and stimulating (Gardner, 1975; Lawrenz, 1975).

Pogge (1986) studied the relationship between students' attitudes towards science and science teaching behaviours of teachers at an intermediate school in the USA. A sample of fifty-two teachers and twelve hundred students enroled in grades four, five, and six were used. The teacher questionnaire contained statements measuring attitudes towards science and science teaching. Pogge found that there were strong positive correlations between students' perceptions of their teachers and their attitudes towards science.

3.2.3.1 SUMMARY

This section shows from a limited number of studies that it is difficult to predict the effect of science teachers' behaviour on students' attitudes. For this reason it is useful to undertake a study to find the correlation between teachers' behaviour and students' attitudes towards science.

3.3 STUDENT VARIABLES

3.3.0 INTRODUCTION

This part reviews research on the effect of interactions of student variables mentioned in chapter 2. These include student attitudes towards science, science self-concept and self-achievement motivation.

Research indicates that the performance of a student at school is influenced by the student's prior performance, by attitudes to specific aspects of school learning and by motivation to learn.

There is clear indication that both achievement and attitudes to school learning are influenced by the students' personality characteristics (Brookover & Erickson, 1969). Therefore, this section looks at the research literature related to student and home characteristics associated with the present study, namely:

1. Attitude Towards Science
2. Achievement Motivation
3. Self-concept.

As indicated in the introduction of this thesis that the aims of this study is to study teacher, student and home in relation to attitude to and achievement in science. The main method to study these variable was to ask students and teachers directly by means of questionnaires. Therefore, it is useful to include also the variables of

1. Home Environment
2. Time Spent on Homework.

The reason for including these variables as student variables is because the data will be obtained by asking students directly.

Before reviewing the previous research in the correlation between attitude towards science and science achievement it is useful to have an idea about what the literature says about the attitude towards science.

3.3.1 STUDENT ATTITUDE TOWARDS SCIENCE

In recent years considerable attention has been given to the affective domain.

While cognitive achievement is the concern of most educational research, there has been a steady increase in interest in student attitude as an outcome of schooling.

Examples within this domain are students' attitudes, perceptions and interests. Bloom (1976), from a comprehensive review of previous studies from 17 countries, suggested that 25% of the variance in science achievement could be attributed to how students felt toward what they were studying, their school environment and their concept of self.

Research studies on the relationship of student attitudes to teacher and classroom characteristics seem to indicate that student attitudes to science may be associated with some classroom, instructional and teacher variables (Gardner, 1975).

Attitude, as it relates to science, is divided into two areas: scientific attitude and attitude towards science. Scientific attitude is the term which refers to the particular approach a person assumes for solving problems, for assessing ideas and information, and for making decisions. It includes such scientific-method predispositions as objectivity, suspended judgement, critical evaluation, and scepticism (Gauld, 1982). Munby (1983) characterized a scientific attitude as thinking as scientists do, that is, acting on evidence in a disciplined way.

Attitude towards science may include attitude toward scientists, scientific careers, methods of teaching science, scientific interests, parts of a curriculum, or the subject of science in the classroom (Blosser, 1984). It may refer to beliefs about processes, theoretical products, technological products, or science-technology relationships (Munby, 1983). Munby (p. 50) categorized some of these attitudes towards science as follows:

Attitude to Science Itself
Attitude Towards the Subject of Science.

Research on attitudes towards science, has concerned itself primarily with three major areas of investigation:

a) the relationships of some classroom (i.e. instructional) variables to students' attitudes.

b) the impact of some instructional techniques and/or instructional courses or programmes on students' attitudes and/or teachers' attitudes.

c) the association between students' attitudes and some students' variables (i.e. background and/or socio-economic variables).

It is this area of attitude to science that concern the present study.

3.3.2 STUDENT ATTITUDE TOWARDS SCIENCE AND ACHIEVEMENT IN SCIENCE.

Developing pupils' attitudes is one of the major purposes of schooling ++and parallels the cognitive achievement in most lists of educational objectives in the school curriculum of any country including Saudi Arabia (ME, 1991).

The relationships of attitudes to academic achievement have been assumed to be logical and inevitable (Gardner, 1975; Schibeci, 1984; Wilson 1983).

Cannon and Simpson (1985) found that attitude towards science appeared to be a predictor in life science achievement in a sample of 821 seventh grade students, 38 classes and 11 different science teachers from Carolina, USA. The science attitude subscale of the Simpson-Troost Attitude Questionnaire was used to measure attitude toward science. Science achievement was measured by using a summative content test written by participating classroom teachers. In the middle of the year, attitude accounted for less than 1% of the variance in life science achievement. By the end of the year, attitude contributed 5% of the variance in life science achievement which is still small.

Talton and Simpson (1987) investigated the relationships of attitude towards science, and achievement in science among tenth-grade biology students. A sample of 1560 students enroled in tenth grade biology class from four schools, 23 tenth-grade science teachers and 70 biology classes from the state of Carolina in USA. Semester grades were used as the measure of student achievement. Subscales of the Simpson-Troost Attitude Questionnaire (Simpson and Troost, 1982) were used to measure attitude towards science variables. They found that 8% of the variance in achievement was accounted for by attitude towards science.

Germann (1988) investigated the relationship between general attitude towards science and several aspects of achievement among high-school students. He designed an instrument to measure student general attitudes towards science, namely, Attitudes Toward Science in School Assessment (ASSA). Germann used a sample of four groups of biological and physical science students from grade 7 through to grade 10 from USA. He found that attitude correlated more substantially with the formative scores than with the summative biology achievement scores. These findings indicate that attitude towards science in school accounted for about 16% of the variation in class work compared to 7% or less for summative scores. A possible explanation for this result is that students with more positive attitudes attend better to classroom instruction, lab exercises, studying and homework than students with a less positive attitude.

A longitudinal study conducted by Oliver and Simpson (1988) tested the influence of attitude towards science, achievement. A sample of 3,902 students responded to investigator-developed, self-report instruments. Course grades were used to measure achievement. The attitude towards science and achievement in chemistry accounted for substantial variance in chemistry achievement of both eleventh (about 20%) and twelfth graders (more than 30%).

These results could be attributed at least in part to the extensive trials as well as clarity and stability of the questionnaires.

In an even more extensive study, Schibeci and Riley (1986) investigated the influence of students' background and correlation between attitudes and achievement. The data analysed came from Booklet 4 given to 17-year-olds during the 1976-1977 National Assessment of Educational Progress (NAEP) survey. The influences of five background variables (sex, race, home environment, amount of homework, and parents' education) on three dependent variables (student perception of science instruction, student attitudes, and student achievement) were examined. Two different models were tested: a model in which attitudes influence achievement and its converse in which achievement influences attitudes. They found that the data supported the former model, that is, attitudes influence achievement.

In a similar study which looked at a wide range of variables, Schibeci (1989) investigated the influence of home, school, and peers on student attitudes and achievement in science among grade 8 science classes from

Perth in Australia. He found that there is positive significant correlation between initial science achievement and general attitudes towards science (0.16), and positive correlation between initial science achievement and final science-related attitude (0.21).

Tamir (1987) studied some factors affecting the science achievement of high school seniors in Israel. A sample of 2277 12th-grade students was used. Tamir found that students' attitudes towards science was positively correlated with achievement in science and explained up to 4.5% of the variation in achievement.

Most of studies mentioned found positive relationships between attitude towards science and science achievement but it is interesting to find a study that has reported a negative result between the two variables. For example, in Saudi Arabia AL-Shargi (1987) investigated Saudi and non-Saudi Arabian male students' attitudes towards science and science achievement of chemistry and physics in secondary schools of Riyadh. Data were collected from 334 male students enroled in eight different secondary schools in Riyadh, using an investigator-developed scale. Both Saudi and non-Saudi students were found to have negative attitudes towards science, although the attitudes towards science of Saudi male students were significantly more positive than were those of non-Saudi males. In science achievement the non-

Saudi male students scored significantly higher on chemistry achievement than did Saudi males.

These results are somewhat surprising because one might assume that a student who has chosen to study science would have a positive attitude towards it.

This could be attributed to some other factors as Backer (1985) and Munby (1983) stated that attitude instruments frequently lack any psychometric basis.

Hough and Piper (1982) provided some evidence for a link between attitudes and achievement gain scores among 583 students from grades 4, 5 and 6. The findings of this study revealed that there was a significant relationship (r=0.45) between pupils' gain scores on the "Hough Pupil Process Test" and their gain score on the "Hough Attitudes Inventory ".

This result is expected because it measures only science process, the other science skills were not measured.

Hamilton (1985) used a sample of 576 Jamaican students to seek a relation between attitudes and achievement on external science examinations. A significant overall positive correlation of 0.29 was found between attitude and achievement, with a higher correlation for females (0.38) than for males (0.20).

The importance of the correlation between attitude towards science and science achievement should lead to more research combining both variables in a wide range of studies.

Fraser (1982) reviewed previous research to find the correlation between attitude towards science and science achievement. He concluded that any relationships between attitudes towards science and science achievement is weak.

Wilson (1983) found in his meta-analysis of the correlation between attitude towards science and science achievement is weak (0.16).

Haladyna & Shaughnessy (1982) reported in their meta-analysis study that the relationship between attitude towards science and science achievement (only in USA) that the relationship between attitude towards science and science achievement was of a low order with only occasional findings that exceeded 10% of the variance. The range of these findings for synthesizable results was from 0.01 to 12.2%, with the median being 2.4%, which is equivalent to a correlation of 0.15. The researchers conclude that there is no strong relationship between attitude and achievement but only a consistently low and positive one.

3.3.2.1 SUMMARY

This section has reported the correlation between attitude to and achievement in science found in some studies world-wide.

It is clear that the correlation between attitude towards science and science achievement is weak, as shown in Table 6.

These results support the conclusion made by Steinkamp & Maehr (1983) that students' science achievement is positively related to affective variables but the relationship is weak.

These results may be attributed to the differences in educational systems, age, race, curriculum etc.,. One important factor restricting the studies has been highlighted by Backer (1985) is that little evidence provided regarding the validity and the psychometric reliability of the scales designed for measuring attitudes toward science.

Table 6

Summary of the findings of the correlation between Attitudes Towards Science and Science Achievement.

Author	Date	Sample	Subject	Country	Correlation
Cannon & Simpson	1985	821 7th Gra.	Life Sc.	USA	0.01
Talton & Simpson	1987	1560 10th Gra.	Science	USA	0.28
Schibeci & Riley	1986	17-year-old	Science	USA	+ve
Oliver & Simpson	1988	3,902 11th& 12	Chemistry	USA USA	0.45 0.55
Germann	1988	Grades 7 and 10	Biology	USA	0.40
Schibeci	1989	Grade 8		Austra.	0.16 0.21
Tamir	1987	2277	Science	Isreal	0.21
Hough Piper	1982	583 4 & 5 Grads	Science	USA	0.45
Hamilton	1985	576	Science	Jamica	0.29
Fraser	1982	Meta-A	Science		Weak +ve
Wilson	1983	Meta-A	Science	USA	0.16
Haladyna et. al.	1982	Meta-A	Science	USA	0.01-12.2% Ave. 2.4% 0.15
Al-sharq	1987	334 10-12th Grads	Chemistry Physics	Saudi Arabia	-ve

3.4 ACHIEVEMENT MOTIVATION

Teachers' experience and research indicate that the performance of a student at school is influenced by the student prior performance, by attitudes to specific aspects of school learning and by motivation to learn.

The single most important thing about humans is that they are motivated to learn (Bruner, 1972). Gagne (1970) considered that motivation is an important student characteristic.

One of the best known theories of motivation is the achievement motivation theory based on the substantial work of McClelland (1951, 1955, 1958) and Atkinson (1954, 1957, 1958, 1965).

Gagne (1970) pointed out that achievement motivation should not be equated with 'motivation to learn'. 'Motivation to learn' refers to the learner's resolve or intention to put in some effort to perform a learning task. It is a momentary intention which may not be very resistant to extinction or frustration. Achievement motivation, on the other hand, is carried beyond the mastery of a task. It refers to a motive or personality trait which is rather stable in nature and can be measured by means of need achievement questionnaires.

In short, achievement motivation theory as proposed by Atkinson (1958) and further elaborated by Atkinson & Feather (1966) holds that individuals, who score high on achievement, will strive to experience success and to excel in a variety of tasks and situations.

Weiner (1984) suggested that significant thoughts and feelings associated with such an attitude as motivation towards school learning, would be known to the individual student. Thus, since attitudes of academic motivation have their origins in previous learning experiences, not only would they be influenced by such experiences, but the students would be aware of attitudes held and could respond meaningfully to questions concerning their attitudes.

Uguroglo and Walberg (1979) reported a meta-analysis of achievement and achievement-motivation correlation on a sample of 40 studies which spanned all of education. They were able to find a correlation in only 13 studies which predicted about 40% of variance in achievement.

Hattie and Hansford (1982) conducted a meta-analysis in a large sample to study the relationship between achievement motivation and achievement for 126 studies in which 1136 correlations where identified. The mean size of the correlation between the two variables was 0.21.

Fraser et al. (1987) in their synthesis of educational productivity found positive significant correlations between motivation and achievement in science (0.34).

3.4.1 SAMMARY

The general findings of research on achievement motivation in educational contexts indicate a small to moderate correlation as indicated in Table seven.

Table 7

Summary of findings related to the correlation between Achievement Motivation and Achievement.

Author	Date	Sample	Subject	Country	Corre.
Uguroges & Welberg	1979	40 Stud. Meta-A	General	USA	0.63 in 13 St.
Hattie & Hansford	1982	126 Stud. Meta-A	General		0.21
Fraser at el	1987	worldwide Synth.	Science		0.34

3.5. SELF-CONCEPT

3.5.0 INTRODUCTION

Many educators and social scientists believe that the self-concept is a very important, if not the single most important personality variable, and essential for academic success (Covengton & Beery, 1976; Bloom, 1976).

In general terms, self-concept is our perception of ourselves; in specific terms, it is our attitudes, feelings and knowledge about our abilities, skills, appearance and social acceptability. Therefore, self-concept is a multidimensional construct, having a general facet and a more specific academic facet.

Self-concept is considered to be a critical variable in education and educational research (Lakey, 1977), as clearly evidenced by the plethora of studies concerned with aspects of self-concept in a variety of educational settings and for a diversity of students, e.g. in the intermediate school (Shavelson & Bolus, 1982), the high school (Calsyn & Kenny, 1977).

The enhancement of students' self-concept is valued as a goal of education and as a moderator and, perhaps, a cause of academic achievement. Wylie, (1974) pointed out in her summary of research that many persons, especially educators, have unhesitatingly assumed that achievement and ability indices are strongly related to self-assessment of achievement and ability, and to overall self-regard.

Much of the research in self-concept since Coopersmith (1959; 1967) to the present time leads to the conclusion that persons are capable of perceiving themselves differently in terms of relatively separate factors, dimensions or facets.

Names for these factors, or dimensions vary from one investigator to another. However, the evidence is overwhelming that a person may, for example, have a very high self-concept of academic ability, but a very low self-concept of physical ability. The relationship between a variable such as achievement and self-concept could be very different depending on the dimension of self-concept measured. Also, one would expect that academic success or failure would influence one's self-concept of academic ability more than one's general self-concept or one's self-concept of physical ability.

One of the factors or dimensions growing out of the multidimensional view is that of self-concept of academic ability. Research, especially Brookover (1969), leads one to expect to find more robust associations between self-concept of academic ability and school achievement than between general self-concept, as well as other self-factors and achievement.

SELF-CONCEPT OF ACADEMIC ABILITY is defined as those attitudes, feelings and perceptions about a person's own intellectual or academic skills which are indicated by that person's responses on a scale or instrument.

3.5.1 THE CORRELATION BETWEEN SCIENCE SELF-CONCEPT AND SCIENCE ACHIEVEMENT

This part report studies related to student academic self-concept and academic achievement.

Interests seeking the correlation between self-concept and achievement have grown world-wide in the last two decades.

In support of the construct validity of self-concept, research has found achievement measures to be more highly correlated with academic than with non-academic self-concept (Byrne, 1984).

Jordan (1981) investigated the unique and common contributions of academic self-concept, and the need for academic competence to the variance in academic achievement of inner-city, black adolescents. Data on these variables were collected from 328 eighth-grade students attending a New York City public junior high school. Results indicate that academic self-concept and the need for academic competence each accounted for significant proportions of criterion variance. Explanations of variance in academic achievement were better for males than for females (0.13 and 0.23 for female and male respectively).

Significant positive correlations between self-concept of academic ability and academic achievement, however, are not always found. For example, Marx and Winne (1975) report no such significant correlations in their data from fifth- and sixth-grade subjects using the Stanford Achievement Test and the revised Sears Self-Concept Inventory (SCI). This finding contrasts with the general pattern of significant positive correlations between both general self-concept and self-concept of academic ability and achievement. This lack of significant correlation is even more interesting in view of another study (Taylor, Winne and Marx, 1975) in which the Sears SCI was found, in a multiple regression analysis, to be a better predictor of academic achievement than two other frequently used self-concept scales, the Gordon scale and the Piers-Harris.

As far as science is concern, Doran and Sellers (1978) investigated the relationships of biology achievement with the self-concept of biology students. Using an investigator-prepared, but well-validated measure of self-concept, and standardized instruments for the other characteristics, the researchers obtained data from 320 students grade 10. Results indicated that the best predictor of self-concept was biology achievement, which predicted 8% of the variance in self-concept.

Sellers (1981) studied 214 high school biology students to determine the relationship between student self-concept in biology and their science achievement. The analysis shown that students who had the highest achievement in biology had the highest self-concept in science.

Woodson (1988) investigated the relationship of self-concept of learning with science achievement. Junior high-school students served as subjects and data were collected using the Self-Concept as a Learner Scale, the Frazer Science Attitude Scale, and 12 unit tests from Merrill's Focus on Life Science. Woodson found no significant relationships between the various predictor variables and science achievement.

Hansford & Hattie (1982) concluded from their meta-analyses of 1136 correlations reported in 128 studies only that self-concept is perhaps "as strongly linked with performance/achievement as any other personological variable.".

Fraser et al. (1987) found in their synthesis a small positive correlation (0.18) between self-concept and science achievement

3.5.1.1 SUMMARY

In general, correlational investigations typically yield significant positive correlations between self-concept of academic ability and achievement.

Although researchers have been enthusiastic to study the correlation between academic self-concept and achievement, the result is not as strong as might be expected. These findings are useful but the size of the correlations, as shown in Table 8, does not have any significant implication in education.

Table 8

Summary of findings of the correlation between Self-concept and Achievement.

Author	Date	Sample	Subject	Cou.	Core.
Fraser et al.	1987	Synth.	Science	USA	0.18
Hansford & Hattie	1982	M-A	Science	USA	+ve
Woodson	1988	J.H.Sc	Science	USA	+ve
Sellers	1981	214	Biology	USA	+ve
Jordan	1981	328 8th grade	General	USA	0.13 0.23
Doran Sellers	1978	320 10th grade	Biology		0.28

3.5.2 SCIENCE SELF-CONCEPT AND ATTITUDES TOWARDS SCIENCE.

Research has been conducted to relate other student self-concept of academic ability with other variables including attitude towards science.

Haladyna et al (1982) concluded in their analysis that there is "powerful evidence" that student attitudes towards science is linked to a positive perception of self and the ability to learn.

Harty et al. (1986) investigated the relationships among the constructs of attitude towards science and self-concept of science ability. Data were collected from 228 sixth-grade students by way of four Likert-type instruments, each of which measured a given attribute. They found that there was a significant positive correlation between attitude towards science and self-concept of science ability (r=0.32).

Hasan (1985) investigated factors affecting attitudes towards science of secondary school students in Jordan. The sample consisted of 313 11th grade science students aged 16-19 (153 boys and 160 girls) from four secondary schools. Hasan found self-concept of science academic ability was the best predictor of attitude towards science. Not only this, but self-concept of science academic ability contributed 11% of the variance, the highest proportion among the eleven investigated variables.

3.5.2.1 SUMMARY

As indicated from the results of the previous studies shown in Table 9, the correlation between science self-concept and attitude towards science is positive though generally weak. Only a limited number of studies have been undertaken, therefore, more studies of the correlation between science self-concept and attitudes towards science could be useful.

Table 9

Summary of findings of the correlation between Self-concept of Academic Ability and Attitudes Towards Science.

Author	Date	Sample	Subject	Count.	Corre.
Haladyna et al.	1982	M-A	Science	USA	+ve
Hasan	1985	313 11th G	Scie.	Jordan	0.33
Harty et al	1986	228	Science	USA	0.32

3.6. HOME ENVIRONMENT (FAMILY BACKGROUND)

As indicated in section 3.2.0, the home environment variable is included in this study because this variable is important for schooling outcomes.

This part reviews the previous research between home environment and school outcomes of achievement and attitudes.

Much of the research on the relation between home environment and school learning has been sociological in nature. These studies have grouped children on the basis of education or occupation of the parents, their social class or socio-economic status, and their race or ethnic background, and then related these classifications to the educational achievement and attitudes of the children in school.

In a study mentioned previously, Fagan and Ponder (1981) found positive low correlation between general achievement of grade eleven student and their parents' educational and occupational level (0.16)

Fraser et al. (1987) found a positive correlation between student achievement in science and home environment (parents education, occupation etc.,), where the size of the correlation was 0.25. They also, found positive lower correlation (0.03) between home environment and student attitude towards science.

The relationship between science achievement and family background was examined by Lee (1987). The study was designed to identify predictors of science achievement of elementary school children in grade three to five in China. Lee found that family background accounted for 9% to 13% of the variance in science achievement.

In a study mentioned previously, Tamir (1987) studied some factors affecting science achievement of high school seniors in Israel. He found that home background such as higher level of parents' education and mothers that work outside home had positive low correlations with science achievement in which all of the home related variables together explained between 1.5% and 3% of the variation in science achievement.

Al-shahrani (1989) found a positive significant relationship between home environment (parents education and occupation) and male students' biology achievement in Southwest Saudi Arabia. Father's educational level showed a significant relationship (0.08) to biology achievement and mother's educational level was also significantly related to biology achievement (0.07).

In a study mentioned previously in Jordon Hasan (1985) obtained a positive correlation between student attitude towards science and mother's or father's educational level which explained 1.68% of the variance in attitude towards science.

3.6.1 SUMMARY

The previous results showed an effect of students' home environment on students' learning outcomes. Although the size of the correlation and the explained variance were in most cases very small, a significant correlation does exist between the home environment and school outcomes.

Table 10

Summary of findings of the correlation between Achievement and Family Background.

Author	Date	Sample	Subject	Country	Cor.
Fagan & Ponder	1981	8,000	General Achieve.	Canada	0.16
Al-sha hrani	1989	Third year 950	Biology Achieve.	Saudi Arabia	0.08 0.07
Tamir	1987	2277 12th	Science Achi. Att	Isreal	0.01-0.17
Hasan	1985	313 11th Grade	science Attitude	Jordon	0.13
Fraser et al.	1987	Synthesis	Science Achieve. Attitude	Worldwide	0.25 0.03

In other words, the correlations between home environment and student achievement and attitudes do exist and probably vary from one country to another depending perhaps on the country's development and the effectiveness of the education system.

3.7 TIME SPENT ON HOMEWORK

As mentioned on page 68 time spent on homework is regarded as one of the student variables. The main reason for including this variable is the frequent engagement of student in doing homework activities which is given on a daily basis in Saudi Arabia.

The influences on school learning are becoming better understood (Walberg, 1984), and many such influences are potentially manipulable by parents, teachers, and schools. One such variable is the amount of time that students spend on homework; homework seems to have a powerful impact on achievement (Keith, 1986; Walberg, Paschal, & Weinstein, 1985). There is ample evidence that homework improves achievement for high school (Foyle, 1984 ; Keith, 1982; Keith & Page, 1985a), and elementary school students (Paschal, Weinstein and Walberg, 1984; Wolf, 1979). Furthermore, homework seems effective for a variety of subject areas (Wolf, 1979).

In a review of research on teaching, Bennett (1982) quotes studies suggesting a positive relationship between the total amount of time spent by pupils on curriculum tasks and their academic achievement.

Recent research in America has considered the relationship between homework and academic achievement and their relationships to parental involvement with their children's education. A large-scale study, involving 28,000 adolescents and over 1,000 schools was undertaken by Keith et al. (1986a). A significant and positive relationship was found between time spent on homework and academic achievement and the researchers concluded that, even after controlling for other variables such as ability and family background, homework had a fairly powerful and positive effect on achievement.

Keith et al. (1986b) investigated the relationship between students' academic achievement and time spent doing homework. A sample of 58,728 seniors and sophomores was selected from high schools. They concluded that time spent doing homework had an important positive effect on student achievement.

A more recent study by Holmes (1989) investigated the relationship between students' self-report about the time they spent on homework and their levels of achievement in school examinations. A cohort of 79 boys was studied from entry to school in 1981 until they took 'O' level and CSE examinations in 1986 in one single-sex grammar school in England. A wide range of data was collected from the boys, their parents and their teachers. The data considered in this study consisted of scores on tests of verbal reasoning administered in the final year of primary school, scores in the internal school examinations at the end of third year and results of public examinations taken at the end of the fifth year. Holmes found that pupils varied considerably in the amounts of time they reported spending on their homework.

At two ages, the levels of time spent on homework had a fairly strong positive association with academic achievement.

Key (1987) found in his research into aspects of science education in English schools that time spent on homework was correlated with science achievement.

In a study mentioned previously Tamir (1987) found that time devoted to science homework was positively correlated with achievement in science.

The meta-analyses of Graue et al (1983) and Paschal et al. (1984) in which 29 and 15 studies were studied to determine the correlation between homework and achievement, the size of the correlations were 0.24 and 0.18, respectively.

3.7.1 SUMMARY

It appears that time spent doing homework has an important, positive, effect on student achievement.

These results may be regarded as important because familiarity with all tasks learned in school is achieved whether in the classroom or at home. However, the above-cited studies were conducted in the West. There is no evidence from research in Saudi Arabia to show whether or not homework is associated with higher levels of achievement, either for individual pupils or for classes or schools as a whole.

Table 11

Summary of findings of the correlations between Time Spent on Homework and Achievement.

Author	Date	Sample	Subject	Country	Corr.
Keith et al.	1986 a,b	28,000 58,728	General	USA	+ve
Holmes	1989	79 primar 3th year 5th year	General	UK	t=53.2 P<0.05 t=45.7 P<.001
Key	1987	10 Years A-Level	Science	UK	+ve
Tamir	1987	2277 Sen.	Science	Isreal	+ve
Graue et al.	1983	29 studies 29 Corr.	M-A	USA	0.24
Paschal et al.	1984	15 studies 81 corr.	M-A	USA	0.18

CHAPTER FOUR

RESEARCH DESIGN

4.0 INTRODUCTION

Much research in education can be classified as one of two types descriptive studies and those aimed at discovering causal relationships.

Descriptive studies are primarily concerned with finding out "what is".

In practical terms observational and survey methods are frequently used to collect descriptive data.

In recent years more research studies have been concerned with discovering causal relationships. A typical causal problem investigated by educational researchers is: **What factors determine student achievement?**

Biddle and Anderson (1986) called these kind of surveys cross-section surveys. This group was later classified into two structures.

(1) **Interviews** which are surveys in which the researcher makes personal contact with respondent and asks series of pre-planned questions. Given the cost of interviews most cross-sectional surveys make use of;

(2) Self-report questionnaires which are instruments for respondents to fill out themselves. Questionnaires are probably the cheapest way of acquiring data

concerning beliefs and attitudes, providing respondents can read and are sufficiently mature to understand and report their feelings.

This study used the questionnaire method of collecting data. This method has been used extensively to collect information about teaching for many years (Anderson et al, 1980).

4.1 INSTRUMENTS USED IN THE STUDY AND METHODS OF COLLECTING DATA.

In this part, the procedures and methodology followed in developing the questionnaires used to gather information from the field and the difficulties faced in conducting the field work will be explained. It also describes how the preparation for both the pilot study and the field work was carried out in the U.K.

The questionnaires used in this study consisted of six separate instruments, four of which were concerned with the students while the other two were concerned with the teachers. Of the latter, one was completed by teachers while the other instrument, which was related to teacher behaviour, was completed by students. These instruments are listed in Table 12.

Table 12

Instruments used for data collection in this study.

1 The Integrated Science Students' Perception of their Science Teacher Questionnaire, ISSPQ. (To be completed by students).
2 Attitude Towards Science in School Assessment, ATSSA. (To be completed by students).
3 Attitude Towards School, Self-achievement Motivation and Self-concept of Academic Ability, ATS, AM and SSCO. (To be completed By students).
4 Science Achievement Test, SAT. (To be completed by students).
5 Teacher and School Resources Questionnaire, TSRQ. (To be completed by teacher).
6 Student and Home Environment Questionnaire, SHEQ. (To be completed by students).

4.1.1 DESCRIPTION OF THE QUESTIONNAIRES

This part describes the instruments which were used in this study and the first determinations of their validity and reliability.

4.1.1.1 INTEGRATED SCIENCE STUDENTS' PERCEPTION OF THEIR SCIENCE TEACHER QUESTIONNAIRE.

This instrument was designed as a result of criticisms of the observation systems adopted by other researchers, in which students perceive their science teachers in different classroom behaviours.

This instrument was originally developed by Al-methen & Wilkinson (1986) as the Science Student Perception Questionnaire (SSPQ) and was later modified by Jegede (1989) to be used for integrated-science students.

The SSPQ is Likert-type instrument with five responses ranging from strongly agree to strongly disagree for each item.

The 46 items of the SSPQ fall within two main categories, teacher behaviour and teacher personality. The nature of the items in each of these categories is as follows:

1) Teacher behaviour

Communication:

Questioning skills 7 items
Communication reinforcement 3 items
Communication in laboratory activities 2 items
Communication and classroom management 3 items

Classroom management:

Classroom management 4 items
Classroom management and reinforcement 1 item
Classroom management in laboratory activities 1 item
Laboratory activities 4 items

Reinforcement - 1 item

2) Teacher classroom personality:

Personal characteristics 4 items
Professionalism 7 items
Personal communication 1 item
Personal classroom management 3 items.

The Integrated Science Students' Perception Questionnaire (ISSPQ) was developed from the SSPQ. The ISSPQ includes four additional characteristics related to pre-classroom behaviour, classroom teaching behaviour, teacher classroom personality and attitudes towards students. The only other differences between the SSPQ and ISSPQ instruments are the addition of pre-classroom characteristics and the rating of items using a three-point scale as shown in the following section, in which each category of items is described. The number of items in each scale of the ISSPQ is as follows:

Teacher Pre-classroom characteristics - 7 items;
Teaching Classroom behaviour - 25 items;
Teacvher Classroom Personality - 10 items and
Teacher Classroom Attitude - 8 items.

This means that the instrument contains 49 items.

The first set of items deals with characteristics related to pre-classroom behaviour, which enables students to evaluate their teacher on 7 items of teaching effectiveness. Students respond by ranking their teacher on dimensions such as scientific knowledge. As indicated in Table 13 all the items of this scale were positive.

Table 13

Items Associated with Pre-Classroom Behaviour Characteristics of ISSPQ.

Items
1 This science teacher knows the subject very well.
2 This science teacher presents the main ideas in an organised and integrated way.
3 This science teacher makes adequate plans for the laboratory activities.
4 This science teacher conducts the laboratory activities confidently.
5 This science teacher collects all the necessary materials for laboratory activities.
6 This science teacher carries out laboratory activities successfully.
7 This science teacher gives satisfactory explanations to students' questions.

The second set of items (see Table 14) deals with characteristics related to teacher behaviour in the classroom. This set asks students to rate the teacher on 25 items, mainly associated with specific teaching behaviours, such as giving an overview of the lesson at the beginning of classes

Table 14

Items Related to Characteristics Associated with Teacher Classroom Behaviour of ISSPQ.

Items	P/N*
1 This science teacher uses simple and clear words when explaining a lesson.	+
2 This science teacher asks questions during a lesson to hold our attention.	+

(Continued Table 14)

Items	P/N*
3 This science teacher gives us a chance or a clue when answering questions.	+
4 This science teacher uses enough audio-visual aids to make a lesson clear.	+
5 This science teacher asks questions during practical work to make sure we understand what we are doing.	+
6 This science teacher asks questions at the end of each lesson.	+
7 This science teacher summarises and goes over the main ideas of a lesson before the end.	+
8 This Science teacher explaines the steps to be taken in an experiment before asking us to do experiments.	+
9 This science teacher does not go over examination papers after they have been marked and does not discuss the results with us.	-
10 This science teacher does not let us experiment on our own as often as we should wish.	-
11 This science teacher does not use homework marks to find out if we need help in understanding our work.	-
12 This science teacher asks questions around the classroom so that we cannot predict who is going to be asked.	+
13 This science teacher gives us a chance to do experiments by ourselves.	+
14 This science teacher does not like us asking him questions.	-
15 This science teacher moves from one subject to another before making sure that we all have understood the previous one.	-

(Continued)

(Continued Table 14)

Items	P/N*
16 This science teacher presents the main ideas in a lesson in a way that is easy to follow.	+
17 This science teacher finds different ways of teaching science to interest us in the subject.	+
18 This science teacher asks more questions than are included in our textbooks.	+
19 This science teacher makes sure we only use observations and results from our experiments as the basis of our thinking and conclusions.	+
20 This science teacher does not allow us to do enough practical work on our own.	-
21 This science teacher finishes topics and experiments in good time before the end of lessons.	+
22 This science teacher spends too much time giving us facts, information instead of practical experimental work.	-
23 This science teacher does not ignore our ideas but makes use of them in discussions.	+
24 This science teacher invites and values various points of view from us.	+
25 This science teacher is very keen on what he/she teaches.	+

*P/N Positive or Negative Item

The third set of items in this instrument is related to teacher classroom personality. These ask the student to make a judgement about the teacher's personality in the classroom, such as teacher's attendance of science classes, teacher's sense of humour, etc. as indicated in Table 15.

Table 15

Items of the ISSPQ Associated with Teacher Classroom Personality.

Items	P/N*
1 This science teacher notices when we are not paying attention or misbehaving and stops us.	+
2 This science teacher permits our discussions to wander too far of the subject.	-
3 This science teacher very often comes late to the classroom.	-
4 This science teacher does not attend all his classes.	-
5 This science teacher does not notice us cheating during lessons and in the examinations.	-
6 This science teacher permits us to show reasonable signs of humour.	+
7 This science teacher wastes a great deal of lesson time on things not connected with the lesson.	-
8 This science teacher orders us around all the time for no particular reason.	-
9 This science teacher has a sense of humour.	+
10 We can depend on this science teacher to hold activities as planned.	+

* P/N Positive or Negative item

Table 16

Items of the ISSPQ Associated with Teacher's Classroom Attitudes to Students.

Items	P/N*
1. This science teacher does not let personal problems interfere with his treatment of us.	+
2. This science teacher punishes the whole class when one or two of us do something wrong.	-
3. This science teacher does not make fun of us for giving wrong answers.	+
4. This science teacher does not make us feel he is proud of us.	-
5. This science teacher trusts and respects us.	+
6. This science teacher deducts marks from our work to punish us.	-
7. This science teacher is fair in marking assignments, homework and examinations.	+
8. This science teacher behaves in the same way towards all of us, regardless of how good we are in science.	+

P/N Positive or Negative Item

The fourth set of items (teacher's attitude towards students) asks students to estimate the likely occurrence of 8 specific observable attitudes of behaviour such as biased attitudes towards students as indicated in Table 16.

Both of these instruments, ISSPQ and SSPQ, were piloted in Nigeria to assess their reliability and to establish their validity (Jegede, 1989). The two instruments were administered to a sample of 2110 Nigerian secondary-school students (1145 boys and 965 girls) selected from Form Two (eight grade) and Form Three (ninth grade).

The ISSPQ and SSPQ both measure science teaching characteristics and behaviour. The main differences, however, relate to the modification of the ISSPQ items to suit the Nigerian classroom environment, adapting the language to the level of English for second-language speakers and the addition of items on pre-classroom characteristics.

The similarity of the two instruments with regards to the constructs they are measuring was said to justify use of the inter-scale correlations as a way of validating each other. The correlation coefficient of the results of the two tests yielded a value of 0.79 (Jegede, 1989).

The ISSPQ differs from the SSPQ in the scoring. Whereas the SSPQ used a five-point Likert type scoring, ranging from strongly agree to strongly disagree, the ISSPQ used a three-point Likert-type scoring system; agree, not sure and disagree, scoring 3,2 and 1 respectively for a positive item and 1,2 and 3 respectively for a negative item.

In this study the ISSPQ will be used for the reason that the shorter, three point scale allows the test to be answered in short time as well, also the addition of the pre-classroom scale enables the instrument to study a wider range of behaviour.

4.2.1.3 THE ATTITUDE TOWARDS SCIENCE IN SCHOOL ASSESSMENT SCALE (ATSSA).

Students' Attitude Towards Science was measured using the Attitude Toward Science in School Assessment (ATSSA) instrument which was developed by Germann (1988). Attitude, in this instrument, is defined as 'the affect for or against a psychological object' (Thurston, 1928; Fishbein, 1967; Mueller, 1986). This is an unidimensional concept of attitude, as opposed to the multidimensional viewpoint promoted by many psychologists, that includes the components of beliefs and behavioural intentions as well as affect. Fishbein (1967a, 1967b) argues in favour of the unidimensional construct. In this view, beliefs and behavioural intentions are determinants of attitude. Furthermore, attitude studies can be made productive by viewing attitude as affect and by considering the other two components to be related to attitude.

This means that attitude here does not include, for example, scientific attitudes which may motivate a person to become a scientist; that may affect performance, competence and success in science as a profession; that may contribute to and lead to acceptance of new knowledge; that may deal with interactions, and dynamics in science; or that may apply to philosophy, ethics, or politics of science. Nor does it include other attitudes towards science, such as towards scientists, towards methods of teaching science, towards scientific interests, or towards particular science courses. Another dimension avoided in this instrument was that of judgements of personal ability in science, the value of science to the individual, or the value of science to society.

The interest of the author in this instrument was to measure a single dimension of a general attitude to science, involving specifically how students feel towards science as a subject in school and the degree to which students like or enjoy science.

The main reason for choosing this particular instrument is its carefully limited scope, with the fact that "science" is not taken to refer to specific courses in school or to specific activities that occur within science classes (i.e, lecture, discussion, lab , homework, field trips, etc).

In developing this instrument, Germann prepared a list of 34 positive and negative statements phrased and listed randomly. Many of these statements were suggested by items in a variety of instruments that assessed attitudes in other areas. Wording was kept simple. No items involved compound sentences or concepts. A Likert scale was devised for student responses: strongly agree, agree, neither agree nor disagree, disagree, strongly disagree. A panel of three judges evaluated the items for construct validity and for clarity. As a result of this evaluation, ten items were removed and the remainder were revised.

The remaining 24 items were pilot tested by Germann (1988) with a group of 125 science students in grades 7 and 8 in U.S.A. In addition, each student made a self-assessment of his or her attitude towards science on a scale from 1 to 10. The teacher also made a similar assessment of each student.

The Cronbach alpha reliability was 0.93. Internal correlations of the items ranged from 0.13 to 0.83. Items were submitted to principal-component factor analysis. Fourteen items were found to load on a factor that best fitted the desired construct of general attitude towards science. These 14 items had the highest inter-total correlations. The instrument consisting of the 14 items loading on the general attitude factor was then further field tested in four studies. The Cronbach's alpha estimates of reliability were greater than 0.95. All 14 items loaded on only one factor with consistent factor loading in all four field studies. Discrimination was demonstrated by item-total correlations ranging between 0.61 and 0.89.

In developing any instrument, the two dimensions of positive and negative attitudes should be considered in order to give a variety of items for students to express their feeling. Therefore, this instrument has 9 positive and 5 negative items, details of which may be found in Table 18.

Table 17

Attitude Towards Science in School Assessment Scale.

Items	Positive/Negative
1 Science is fun.	+
2 I do not like science and it bothers me to have to study it	-
3 During science class, I am usually interested	+
4 I would like to study more about science.	+
5 If I know I would never go to science class I would feel sad.	+
6 Science is interesting to me and I enjoy it.	+
7 Science makes me feel uncomfortable, restless, irritable, and impatient.	-
8 Science is fascinating and fun.	+
9 The feeling that I have towards science is a good feeling.	+
10 When I hear the word science, I have a feeling of dislike.	-
11 Science is a topic which I enjoy studying.	+
12 I feel at ease with science and I like it very much.	-
13 I feel a definite positive reaction to science.	+
14 Science is boring.	-

4.1.1.2 ATTITUDE TOWARDS SCHOOL SELF-ACHIEVEMENT MOTIVATION AND SCIENCE SELF-CONCEPT.

This instrument was designed to measure student attitude towards school, self-achievement motivation and science self-concept in which students express their attitude towards school self-achievement motivation and their academic self-concept.

These three scales were chosen from a number of scales to fit in with the purpose of this study as follows:

1. Attitude Towards School - 6 items
2. Achievement self-motivation - 4 items
3. Science Self-concept - 2 items

These three scales were developed by Talton & Simpson (1982) and used in longitudinal research in USA (see appendix 3). Table 17 indicates the reliabilities of these sub-scales for a sample of grade-nine students as measured by Talton & Simpson (1986). The reason for including the results of the reliability of grade-nine reliability, is that, it is a similar grade sample which the researcher is intending to use.

Table 18

Attitude Towards School, Self-achievement Motivation and Science Self-Concept Questionnaire (Taken from Talton & Simpson (1986).

Scale	RELIABILITY*
Attitude Towards School 1. Most teachers at this school are fair with students. 2. I feel like I am in prison when I am at school. 3. I am under great pressure at school. 4. The principal of this school is nice. 5. I feel like I have little control over what happens to me at school. 6. The harder I try, the better I do in school.	0.42
Self Achievement Motivation 1. I always try hard, no matter how difficult the work. 2. When I fail, that makes me try that much harder. 3. I always try to do my best in school. 4. I try hard to do well in science.	0.67
Science Self-Concept 1. I consider myself a good science student. 2. I think I am capable of becoming an engineer, doctor.	0.60

* From Talton & Simpson

The Attitude Towards School scale consisting of 6 items, is included in the current study, because of the importance of attitude towards school, which may have a strong effect on the learning outcomes (Bloom, 1976).

These three scales were scored on a 5-point Likert-type scale ranging from strongly agree (score of 5) to strongly disagree (score of 1) for a positive item with the reverse scoring for a negative item.

As Table 17 indicates that the reliability of these three scales in the study of Talton and Simpson was considerably lower than the value expected from attitude scales. These low values may in part be due to the small number of items in each scale.

4.2.1.4 THE SUDENT SCIENCE ACHIEVEMENT TEST

In general an achievement test is a systematic procedure for determining the amount a student has learned.

As already explained for this study it is important to assess how selected behaviours and classroom personality characteristics of integrated science teachers in intermediate school are related to student achievement. Assessment of the students' scientific knowledge based on their science curriculum is used as an important and clear criterion by which to measure the effectiveness of the science teacher as put forward by Keeve (1975).

The construction of the science achievement test was an important aim of the research, because there were no locally standardized Integrated Science Tests available. This could be attributed to the lack of educational research, as stated by Al-Baadi (1985), as well as the newly-established nature of the educational system in Saudi Arabia, as was discussed in Chapter Two.

It was also thought that a standardized scientific instrument could be useful and could save a great deal of time and effort, but the idea was abandoned because of the different culture and differences in the curriculum taught in the schools. For these reasons, the researcher designed a science achievement test simply to serve the purpose of the study in Saudi Arabia.

To construct the science achievement test the researcher used ideas and recommendations of Gronlund, (1982) and Gronlund et al. (1990) as how to build an appropriate and reliable instrument. The achievement test to be most useful must cover most of the science syllabus taught in class yet not be time-consuming or tiring for students. It was decided that multiple-choice items could meet these criteria better than any other type of test, and could be used to assess both knowledge outcomes and other intellectual skills.

A study of the science curriculum in Saudi Arabia within intermediate and secondary schools, showed great emphasis is placed in the whole curriculum on knowledge of facts and understanding of concepts and ideas, rather than any other kind of cognitive skills. Therefore, most of the items were designed to fit into the first two categories of Bloom's Taxonomy. A limited number of more complex and mathematical items was developed to assess the use of information.

Based on these decisions a multiple-choice science test, with four alternatives was developed by the researcher, with the aid of experienced science teacher from the third year of an intermediate school. A total of 40 items was designed relating solely to topics taught in the second term of the year.

According to the educational system in Saudi Arabia the topics of any curriculum are divided into two parts.

The first part is taught and examined at the end of the first term, while the second part is taught and examined at the end of the academic year.

The researcher was only interested in the second-term syllabus of the third year science curriculum. The curriculum covers five units in the first and the second terms; therefore the last three units which are taught in the second term were chosen from the following topics:

1. **Environment**

2. **Genetics (Biological)**

3. **Energy; changes and transfers**
   - **energy and movement (energy and work,)**
   - **Energy and change (Heat energy)**
   - **Changing the energy (change from one form of energy to another, e.g, chemical energy to electrical energy)**
   - **Transfer of energy (transferring energy by electric current, waves)**

4. **Technology**
   - **Transportation**
   - **Communication and**

5. **Organic Chemistry**

The Science Achievement Test was given to three judges: a college of education lecturer, a science supervisor and a science teacher to comment on the content validity of the science achievement test.

It was decided by the judges that the 3 items on organic chemistry should be deleted because this topic was usually taught just a week before the second term's final exam, where the absenteeism percentages are likely to be higher and higher proportion of students might not answer these questions.

The following questions were designed according to the contents of the student science book for the third year of intermediate school (age 14^+ years) to test student science achievement.

The Student Science Achievement Test Items

1 The unit of work is (Energy & Movement)
1. The Gramme 2. The Celsius
*3. The Joule 4. The Fahrenheit.

2 Which of the following describes the thermal equation accurately? (Energy & Movement)
*1. The mass of the hot water X specific heat X change in temperature = The mass of cold water X specific heat X change in temperature.
2. The amount of lost energy = The amount of gained energy.
3. M1 x N1 x Δ T1 = M2 x N2 x Δ T2
4. M1 X specific heat x Δ T1 = M2 x specific heat x Δ T2.

3 The unit in which temperature is measured: (Energy & Movement)
*1. Degree centigrade 2. Joule 3. Calorie
4. Gramme

4 Which of the following is not regarded as a source of energy? (Energy & Movement)
1. Sun *2. Sand 3. Oil 4. Electricity

(Continued)

5 Work is: (Energy & Movement) *1. Force x distance 2. mass x volume 3. mass x density 4. density x volume	
6 The amount of work which is needed to lift a body weighing 70 N to a distance of 7m is: (Energy & Movement) 1. 49000 Joules (newton-meter) *2. 490 Joules 3. 49 Joules 4. 4900 Joules	
7 What is the weight of a body which can be lifted to a height of 3m if work done is 150 joules? (Energy & Movement) 1. 150 newtons 2. 5 newtons 3. 500 newtons *4. 50 newtons	
8 You employ work of 250 Joules to lift a box weighing 50 N. How high do you lift it? (Energy & Movement) 1. 50 m 2. 15 m *3. 5 m 4. 150 m	
9 The potential energy which results from gravity is; (Energy & Movement). *1. Weight x height 2. Mass x volume of the body 3. Density x height 4. Density x volume	
10 When you lift a body to a certain height, which of the following does not happen? (Energy & Movement) 1. I consume energy 2. I consume work 3. I consume effort *4. I consume volume	
11 Energy cannot be created or destroyed, but it can be changed from one form to another. This is the principle of: (Energy Change). 1. Fraction 2. Kinetic energy 3. Potential energy *4. Energy	
12 The energy of an object at rest or at a particular height is called: (Energy Change). 1. Friction 2. Energy *3. Potential energy 4. Work	

(Continued)

13 Which one of the following equations represents the amount of heat energy in a body? (Energy Change). 1. Mass x density x specific heat 2. Mass x density x change in temperature *3. Mass x specific heat x change in temperature 4. Mass x volume x temperature.
14 The specific heat capacity of a substance is: (Energy Change). 1. The amount of energy (in joules) which is needed to raise the temperature of 1 gram of water by one degree centigrade. 2. A mixture of two liquids of different temperatures to become one temperature. *3. The amount of energy which is needed to raise the temperature of 1 gram of substance one degree centigrade 4. The amount of temperature which is needed to change a substance from gas to a liquid.
15 The specific latent energy of water is; (Energy Change). 1. The change of a substance from a liquid to gas. *2. 540 Calories/gramme (In the students' textbook). 3. The change of substance from solid to gas without going through the liquid state. 4. The amount of energy which is needed to raise the temperature of 1 gramme of water one degree centigrade.
16 Evaporation is: (Energy Change). *1. The change of a liquid to a vapour, at a temperature below, or at its boiling point. 2. The change of a substance from gas to liquid. 3. The amount of energy which is needed to raise the temperature of 1 gramme of water one degree centigrade 4. The amount of temperature which is needed to change a substance from gas to a liquid.
17 Condensation is: (Energy Change) 1. The movement of energy of the molecule of a body. *2. The change of a vapour or gas to a liquid when cooled. 3. The change of a substance from solid to gas without going through the liquid state. 4. A mixture of two liquids at different temperatures to reach one temperature.

18 Which one of the following machines could not change electrical energy to kinetic energy? (Energy Transfer). 1. Fans *2. Microphone 3. Washing machine 4. Food mixer
19 An Iron for pressing clothes is an example of the change of energy from : (Energy Transfer). 1. Electrical to chemical 2. Heat to chemical 3. Electrical to kinetic *4. Electrical to heat.
20 Falling water driving a dynamo is an example of the change of potential energy to : (Energy Transfer) 1. Kinetic energy then to chemical energy 2. Heat energy then to chemical energy *3. Kinetic energy then to electrical energy 4. Kinetic energy then to heat energy
21 Satellites carry small instruments which work to transfer energy. They; (Energy Transfer). *1. Change light energy to electrical energy 2. Change chemical energy to electrical energy 3. Change kinetic energy to electrical energy 4. Change light energy to chemical energy.
22 The discharge of a car battery is an example of a change of energy from; (Energy Transfer). 1. Electrical energy to kinetic energy 2. Electrical energy to heat energy. 3. Electrical energy to chemical energy. *4. Chemical energy to electrical energy and then to kinetic energy.
23 Burning the fuel in the motor of a car is a result of changing (Energy Transfer). 1. Kinetic energy to chemical energy then to heat energy. 2. Chemical energy to heat energy. 3. Chemical energy to light energy then to heat energy. *4. Chemical energy to heat then to kinetic energy
24 The oxidation of food in the body produces; (Energy Transfer) 1. Electrical energy 2. Kinetic energy 3. Light energy *4. Heat energy

(Continued)

25 Nuclear energy is produced as a result of : (Energy Transfer). 1. Separation of electrons from the atoms *2. Nuclear fission of the atoms 3. Reaction of the atoms 4. Increase in the attraction between parts of the nuclei of the atom. (Option 2 is the correct answer accourding to student science textbook in Saudi Arabia).
26 Many countries in the world do not use nuclear energy because: (Energy Transfer). 1. It is difficult to produce nuclear energy. 2. It is difficult to build a nuclear station. *3. It is dangerous and costly to produce nuclear energy. 4. There is a shortage in the raw materials to produce nuclear energy.
27 The transfer of energy by waves has been used in many fields. Which one of the following does not use wave energy in order to work? (Energy Transfer). 1. Radio 2. Television *3. Air conditioner 4. radar
28 When an electric current runs through a lamp the energy is changed from: (Energy Transfer). 1. Chemical energy then to heat energy 2. Electrical energy then to kinetic energy. *3. Electrical energy to heat energy then to light energy. 4. Chemical energy then to heat energy
29 The internal and external combustion engine depends on the idea of stored energy. Which of the following does not have stored energy? (Technology). *1. Sand 2. Wood 3. Coal 4. Oil
30 The mouthpiece of the telephone contains small granules of (Technology). *1. Carbon 2. Iron 3. Lead 4. Silver

(Continued)

31 Which one of the following scientists did not participate in inventing or improving the steam engine: (Technology). 1. Hero 2. James Watt 3. Fulton *4. Archimedes
32 Small calculators, computers and electrical storage depend in their manufacture on: (Technology). 1. The Cylinder 2. The Piston 3. The Fuel room *4. The Transistor
33. The turbine engine consists of three parts. Which of the following is not regarded as a part of the turbine engine? (Technology). *1. Piston 2. Fuel room 3. Cylinder 4. Gaseous Turbine
34. The rocket consists of three parts. Which of the following is not regarded as a part of the rocket? (Communication). 1. Fuel room 2. Burning room *3. Piston 4. Gaseous Turbine
35. Who invented the Telephone? (Communication). 1. Hero *2. Graham Bell 3. Stevenson 4. Watt
36. Which one of the following factors does not lead to technological development? (Communication). 1. Availability of scientists and engineers. 2. The availability of energy sources (oil, gas and electricity. 3. The availability of financial resources (money etc) *4. Shortage of skills and specialists.

* Indicates the correct answer for each item.

The items of the science achievement test were classified according to Bloom's (1956) taxonomy of Knowledge, Comprehension, Application, and Evaluation, as can be seen in Table 19.

TABLE 19

CONTENT, SPECIFIC CONTENT, OBJECTIVES OF ITEMS AND TOTAL OF ITEMS FOR EACH CONTENT AND SPECIFIC CONTENT.

GENERAL & SPECIFIC CONTENTS	OBJECTIVE OF ITEM				TOTAL NUMBER
	KNOW.1	COMP.2	APPLI.3	EVAL4	
ENERGY					
ENERGY & MOVEMENT	3 (1,3,4)	2 (9, 10)	4 (2, 6,7, 8)	0	9
ENERGY CHANGE	5 (11, 12, 13 14, 15)	2 (16, 17)	0	0	7
ENERGY TRANSFER	6 (18, 25, 26 27, 29 and 30)	8 (19, 20 21, 22, 23 24 and 28	0	0	14
TECHNOLOGY					
TRANSPORTATION	3 (31, 32, 33)	0	0	0	3
COMMUNICATION	3 (34, 35, 36)	0	0	0	3
TOTAL	20	12	4	0	36

1. KNOWLEDGE
2. COMPREHENSION
3. APPLICATION
4. EVALUATION

In Table 19 items of the science achievement test were designated within the topic of "Energy and Movement" in which 3 items were classified as knowledge, 3 items as comprehension and 4 items as application. For the topic of "Energy Change", 7 items were constructed to fall into two of Bloom's classifications in which 5 items were knowledge and 2 items were comprehension.

For the topic of "Energy Transfer" 14 items were designed in which 6 items were knowledge, 8 items were comprehension.

Finally, for the topic of "Technology" which included "Transportation and Communication" a total of 6 items were designated so that for "Transportation" 3 items were knowledge, and for the "Communication" 3 items were allocated to knowledge.

A discussion of the try-out of the achievement test and its item analysis is described in Chapter five.

4.2.1.5 TEACHER AND SCHOOL RESOURCES QUESTIONNAIRE

This questionnaire consisted of four parts. Details of each part of the questionnaire are given below.

PART ONE

1. Name of the school in which you teach
2. Nationality. Saudi Non-Saudi
3. Age 25 and below 26-30 31-35 36-40 (others)
4. If you are a contracted teacher, please indicate howlong you have been in the country.

below 5 years 5-10 years 10-15 years

PART 2

The next set of questions were designed to find out some information about the teacher's qualifications, experience and average numbers of pupils in science classrooms.

Teacher's Qualification

1. Diploma in Science and Mathematics
2. A B.Sc. degree
3. A B.Sc & Education degree
4. A M.Sc. degree
5. M. Ed. degree
6. Others

Teaching Science Experience

1. Less than 3 years
2. 3-5 years
3. 5-10 years
4. 10-15 years
5. Others

Number of Students in the Classroom

1. 16-20 students 2. 21-25 students 3. 26-30 students
4. 31-35 students 5. 36-40 students

Teaching Load.

1. Less than 15 2. 15-19
3. 20-24 4. More than 24

PART 3

Teachers' Opinions of the Science Curriculum they teach.

1. Easy 2. Easy and Over-loaded
3. Difficult 4. Difficult and Over-loaded

PART 4

Availability of Scientific Materials

1. Too Much 2. Not enough 3. Not Available

It should be noted that most of the questions were kept short to improve the response rate.

4.2.1.6 STUDENT AND HOME ENVIRONMENT QUESTIONNAIRE.

This questionnaire was designed to investigate student and home variables. Student variables were restricted to age, nationality and family size, while home variables consisted of parent education and family socio-economic status. This instrument was designed by the researcher. The instrument is listed below:

PART 1

Preliminary Student Variables

1. Age of the student: 14 15 16 17 18 19^+
2. Nationality of the student:
   Saudi Non-Saudi
3. Family Size 2-4 More than 4 children

PART 2

Father's Education

1. He does not read nor write
2. He reads and writes but does not have formal qualifications
3. He has a primary Education
4. He has an intermediate Education
5. He has a diploma (nursing, teaching etc.,)
6. He has a secondary Education
7. He has a degree.
8. Other (higher education).

PART 3

Mother's Education

1. She does not read or write

2. She reads and writes without formal education
3. She has a primary Education
4. She has an intermediate Education
5. She has a diploma (nursing, teaching etc.,)
6. She has a secondary Education
7. She has a higher Education
8. Other

PART 4

Father's Occupation

1. Government clerk
2. Works in the private sector (Company, banks etc.,)
3. Businessman
4. Vocational
5. Self employed
6. Farmer
7. Retired
8. Unemployed
9. Other

PART 5

Mother's Occupation

1. Housewife
2. Working (nurse, teacher etc.,)
3. Other

4.3 SOCIO-ECONOMIC STATUS IN SAUDI ARABIA

One problem, the researcher faced, was a decision as to how to order parents' occupations in terms of economic status, as such an order in Saudi Arabia may differ from those of other countries. To solve this problem, the researcher designed a questionnaire in which all possible occupations were listed. These included governor (amir), doctor, director, engineer, policeman or military officer, supervisor, headteacher, teacher, businessman, worker in the private sector, self-employed, technician, mechanic, farmer, retired, and unemployed etc.

The questionnaire was given to an initial total of 20 subjects who were businessmen, self-employed, head teachers and teachers. They were asked to rank these occupations according to their opinion as to their social and economic status within Saudi Arabia and to give reasons for their order.

They suggested that the order for a social-economic classification in Saudi Arabia should be:

1 Government employees (civil servant, teacher, policeman and military officer); all the subjects agreed that these occupations should be first because of the security offered of a monthly income for the whole life of the employees.

2 Businessman (big companies, or big business owners; 18 subjects agreed that this occupation should be put in second place.

3 Work in the private sector (company, banks etc); this was agreed by 17 subjects to be in third place.

4 Professional (engineer, technician, or mechanic); it was agreed by 19 subjects that this occupation should be in fourth place.

5 Self-employed (sellman, taxi drivers etc.; 18 subjects placed this category in the fifth place.

6 Farmer; considered by 17 subjects to be the sixth most important occupation.

7 Retired; put in seventh place by 16 subjects.

8 Others; put in the eighth place by 15 subjects.

As there was very high agreement, as to the rank of different categories of occupations, among the twenty subjects it was considered not necessary to undertake any additional statistics to assess more rigorously the degree of agreement. Because of such a high agreement, considerable confidence can be placed on these socio-economic ranking derived from the responses of individuals representing both the business and professional community in Saudi Arabia.

For mother's occupation the ranking started from working women (teacher and nurse), other and housewife.

For parents education the ranking started from the highest qualification to the lowest qualification.

4.4 RESEARCH PROPOSALS

The main purpose of this research was to undertake the first comprehensive empirical study in Saudi Arabia to explore the influences of a variety of variables associated with the student, the teacher and the home on both student attitudes to and achievement in science. Thus, the relationships between such variables as students' perceptions of their teachers, student's science self-concepts, students' achievement and attitudes to science, teachers' qualifications, and family background were explored.

The researcher sought answers to the following questions:

1. What are the main Characteristics of Intermediate Schools for Students aged 12 to 15^{+} years in Southwest Saudi Arabia?

2. How do Saudi Arabian Intermediate Male Students Perceive their Science Teacher?

3. Are there any significant relationships between Student Science Achievement and Attitude Towards Science and each of the following variables: Teacher's Pre-classroom Behaviour, Teacher Classroom Behaviour, Teacher Classroom Personality, Teacher Classroom Attitude, Teacher Teaching Qualification, Teacher age, Teacher Race and Teacher Teaching Experience?

4. Are there any Significant Relationships between Students' Attitude Towards School, Self-achievement Motivation, Science Self-concept and their Achievement and Attitude Towards Science?

5. Are there any Significant Relationships between Student Achievement and Attitude Outcomes and Family variables (socio-economic status and Family Size)?

6. Are there any Significant Relationships between Time Spent On Homework, Students' Attitude Towards School, Science Self-concept, and Self-achievement motivation and student schooling outcomes?

7. Are their any Significant Interrelationships between Teachers' Pre-classroom and Teacher Classroom Behaviour and Students' Attitude Towards School, Self-achievement Motivation and Science Self-concept?

8. What are the contribution of Teacher, student and Home variable on student attitude to and Achievement in Science?

4.4.5 SUMMARY

As already explained a number of instruments were adopted from others (e.g., ISSPQ from SSPQ). Other newly constructed instruments have no basis for validity and reliability (e.g., the science achievement test) while the rest of the instruments are factual questions.

As mentioned that the ISSPQ, ATSSA, ATS SAM and SSC were adopted from USA UK and Nigeria which have different culture and different school systems and curriculum. Therefore, applying these instruments in this study will be useless unless a pilot study is conducted to find out how suitable these instruments for this country culture and students are.

It was thought that a pilot study might be useful for getting an appropriate result. Therefore, all this study's instruments were taken to be piloted in Saudi Arabia and this is the subject of next chapter.

CHAPTER FIVE

PILOT STUDY

5.0 INTRODUCTION

The pilot study is a very important stage in research of this kind, and is crucial in that it enables refinements to be made if necessary to the instruments before use in the main study. Using the results obtained from the pilot study, much information may be obtained to support the use of the chosen instruments, or to lead to a decision as to whether to use a specially-designed local instrument or a standardized instrument.

The confidence placed in procedures used in educational, social and psychological work is based to a great extent on the validity and reliability of the contents of the measuring instruments.

5.1 VALIDITY AND RELIABILITY OF INSTRUMENTS.

Evidence is needed on the reliability and validity of any instrument which may be used in research. This is important because many researchers develop instruments to serve their own purposes but must still provide evidence of their value in educational research. The use of reliable tests decreases measurement errors and allows more confidence to be placed in the results of the research.

It is worthwhile to provide the definition of the validity and reliability and their kinds.

5.1.1 VALIDITY:

Validity refers to the appropriateness of the interpretations made from test scores and other evaluation results, with regard to a particular use Gronlund et al (1990). In the case of an achievement test, we should be able to interpret the scores as a relevant and representative sample of the achievement domain to be measured.

Gronlund et al. (1990) identified three kinds of validity. These are:

1. **Content-Related Evidence**, which refers to how well the sample of the test tasks represents the domain of the tasks to be measured.

2. **Criterion-Related Evidence**, which refers to how well test performance predicts future performance or estimates current performance on some valued measure other than the test itself (called a criterion).

3. **Construct-Related Evidence**, which refers to how well test performance can be interpreted as a meaningful measure of some characteristic or quality.

The researcher was confident about the various research questionnaires because of the procedures used to assess the validity and reliability of ISSPQ, ATSSA, Attitude Towards School, Science Self-concept and Self-achievement Motivation instruments. However, because of the different culture and educational system of Saudi Arabia the researcher decided that all the study instruments should be assessed **within Saudi Arabia** to increase confidence in their use.

The pilot study was undertaken in two stages: the first included the **ISSPQ** and **ATSSA** instruments while the second contained the Attitude Towards School, Science Self-Concept and Self-Achievement Motivation instruments. The pilot study also included an item analysis and reliability study of the achievement test.

Copies of the ISSPQ and ATSSA which were available at that time (the other instruments Attitude Towards School, Science Self-concept and Self-Achievement Motivation were obtained from USA; Appendix A) were translated into Arabic from English by the researcher. Three Saudi and Non-Saudi students studying English as a second language in U.K. Universities were asked to give their opinions as to the correctness of the Arabic translations of these instruments.

Prior to the pilot study, these two instruments were given to 3 judges, one from one of the local education authorities, a lecturer from a college of education (teaching college) and a local education science supervisor and a science teacher, to seek their opinions as to the content validity of the instruments. From their comments, some minor alterations were made and incorporated in the final versions of the instruments.

The judges recommended that the researcher should obtain further information of the suitability of the instruments from distributing them to students. So a pilot study was carried out. Before administering these instruments to students, the following alterations, as suggested by the judges, were made regarding the questionnaires.

5.1.1.1 THE ISSPQ:

Six items of this instrument were not included because four of these items were related to laboratory activities, and were based on the assumption that students carried out laboratory work and investigation themselves, as a main source of science information. However, in most intermediate and secondary schools in Saudi Arabia, this is not the case; most experiments are demonstrated by teachers.

The other two items were considered to be unsuitable for students to rate on the recommendation of the judges.

The Six deleted items were:

1. This science teacher explains the steps to be taken in an experiment before asking us to do an experiment.

2. This science teacher makes sure we only use observations and results from our experiments as the basis of our thinking and conclusions.

The reason for not including these two items is that student do not do practical work themselves.

3. This science teacher does not allow us to do enough practical work on our own.

4. This science teacher does not let us experiment on our own as often as we should wish.

The main reason of not including these items because they overlaps with item 12 in the same scale.

5. This science teacher orders us around all the time for no particular reason.

6. This science teacher wastes a great deal of lesson time on things not connected with the lesson.

These two items were deleted because of social milieu.

In addition, the wording of two items of the ISSPQ were modified. These were:

1. This science teacher uses enough audio-visual and other living and non-living aids to make a lesson clear.

From: This science teacher uses enough audio-visual aids to make a lesson clear.

2. This science teacher asks questions during practical work to make sure we understand what we are doing.

From: This science teacher asks questions during practical work to make sure we understand what he is doing.

5.1.1.2 ATTITUDE TOWARDS SCHOOL SELF-ACHIEVEMENT MOTIVATION AND SCIENCE SELF-CONCEPT.

This instrument was piloted prior to the main study (with the details of the three scales given in Chapter 4). They were translated by the researcher and given to one of the teaching college lecturers (from the Educational Psychology Department) to verify the accuracy of the translation, as well as the suitability of the items to measure these traits.

Only a few of these items were rewritten to suit the students of ninth grade in Saudi Arabia as recommended by the judge. Of the school attitude sub-scale, only three items were modified as a result of recommendations made by the judge.

The Attitude Towards School items which were not included were:

ATTITUDE TOWARDS SCHOOL

1. The Principal of this school is nice.

2. I feel that I have little control over what happens to me at school.

These items were deleted because of social milieu

3. The harder I try, the better I do in school.

This item look similar to item 1 of the self-achievement motivation

SELF-ACHIEVEMENT MOTIVATION

One item of self-achievement motivation scale was slightly modified. This was

I always try hard, no matter how difficult the school work.

The word "work" was changed to "School work"

5.1.1.3 ATTITUDE TOWARDS SCIENCE IN SCHOOL ASSESSMENT

No alterations were recommended regarding the ATSSA.

5.1.1.4 THE STUDENT SCIENCE ACHIEVEMENT TEST.

Some questions of the Science Achievement Test were slightly re-worded on the suggestion of the judges to ensure the meaning would be understandable to all students, bearing in mind their age and educational level.

5.1.2 RELIABILITY

5.1.2.0 INTRODUCTION

Before providing the results of the trial of these study instruments, it is important to mention what reliability means and the kind of the reliabilities used in education.

Reliability refers to how consistent test scores or other evaluation results are from one measurement to another Gronlund et al (1990). Again, this is a very important point to establish to gain information about the usability of locally-made or standardized tests. Four kinds of reliability tests are commonly used. These are:

1. **Test-Retest Method:** This kind of reliability refers to the stability of test scores over some given period of time.

2. **Equivalent-Forms Method:** This reliability refers to the consistency of the test scores over different forms of a test (that is different samples of items)

3. **Test-Retest with Equivalent Forms:** This refers to the consistency of test scores over both a time interval and with different forms of the same test.

4. **Internal Consistency Method:** This kind of reliability refers to the homogeneity of test scores over different parts of the test.

In this study the test-retest and the internal consistency method were used to measure the reliabilities of the instruments used.

5.1.2.1 RESULTS OF THE PILOT TEST RELIABILITIES

In the first part of the reliability studies the ISSPQ & ATSSA instruments were given to intermediate male students from two schools, both from the Jizan local education authority in the South-west of Saudi Arabia with the help of the Saudi Educational Attache in London. A sample of 198 third-year intermediate students age 15^{+} from 5 classes was selected. One school consisting of 3 classes was located in an urban area, while the other, consisting of 2 classes, was located in a rural area. The sample was requested to participate in the pilot study in the middle of May 1990. All students in the pilot study were administered the Integrated Student Science Perception Questionnaire (ISSPQ) scales and the Attitude Towards Science in School Assessment (ATSSA) scale, using a single administration only. Students were given full written instructions as to how to answer the questions, and to save time, the researcher demonstrated to the students how to answer the instruments. They were also reminded that these instruments would have no effects on their school examinations or results. Moreover, the results of their ratings would not be shown to any person, irrespective of his/her position, except the researcher, for his own purposes. The researcher directed the distribution and completion of all instruments, without the presence of any science teacher or other person.

The results were coded to make them ready for statistical analysis which was executed in U.K in Hull University Computer Centre.

5.1.2.1.1 THE RELIABILITY OF THE ISSPQ INSTRUMENT.

To determine the reliabilities of this instrument it was necessary the four scales should be treated independently as recommended by Gardner (1976) and Munby (1983).

5.1.2.1.1.1 TEACHER PRE-CLASSROOM BEHAVIOUR

As already explained the scale Teacher's Pre-classroom Behaviour had seven items, the results of the statistical analysis of these items are shown in Table 20. The mean of the items ranged from 2.52 to 2.10 while their standard deviations ranged from 0.59 to 0.83. The alpha reliability for the whole scale was 0.73.

The column α_{n-1} show that if item 1 is omitted, the scale reliability increases very slightly from 0.73 (whole scale) to 0.74. It was decided that it was not necessary to delete item 1 from the scale, the scale is acceptably homogeneous.

Table 20

Means, Standard Deviations and Alpha if Item is deleted for Items Associated with Teacher Pre-Classroom Behaviour of ISSPQ (N=198).

Items	Mean	SD	α n-1
1 This science teacher knows the subject very well.	2.52	0.59	0.74
2 This science teacher presents the main ideas in an organised and integrated way.	2.53	0.70	0.71
3 This science teacher makes adequate plans for the laboratory activities.	2.14	0.83	0.69
4 This science teacher conducts the laboratory activities confidently.	2.35	0.73	0.68
5 This science teacher collects all the necessary materials for laboratory activities.	2.10	0.81	0.68
6 This science teacher carries out laboratory activities successfully.	2.49	0.64	0.69
7 This science teacher gives satisfactory explanations to students' questions.	2.31	0.83	0.70
Total	2.35	0.73	0.73

5.1.2.1.1.2 TEACHER CLASSROOM BEHAVIOUR

For the scale of Teacher Classroom Behaviour, the pilot-study results are presented in Table 21. The results indicated that the means for teacher classroom-behaviour items of ISSPQ ranged from 2.86 to 1.49 and their standard deviations ranged from 0:50 to 0.92. The alpha reliability for the whole scale was 0.66. Table 21 also provide details of the alpha reliability if individual items are deleted one at a time from the scale. The Table shows that only one item, No.18, is associated with sizable increase in reliability (from 0.66 to o.73).

Table 21

Means, Standard Deviations and Alpha if Item is deleted of Items Associated with Teacher Classroom Behaviour of ISSPQ (N=198).

Items	Mean	SD	α n-1
1 This science teacher uses simple and clear words when explaining a lesson.	2.80	0.50	0.69
2 This science teacher asks questions during a lesson to hold our attention.	2.77	0.58	0.68
3 This science teacher gives us a chance or a clue when answering questions.	2.45	0.83	0.67
4 This science teacher uses enough audio-visual aids to make a lesson clear.	1.86	0.86	0.68
5 This science teacher asks questions during practical work to make sure we understand what he is doing.	2.46	0.76	0.68
6 This science teacher asks questions at the end of each lesson.	2.49	0.82	0.68

(Continued Table 21)

Items	Mean	SD	$\propto$ n-1
7 This science teacher summarises and goes over the main ideas of a lesson before the end.	2.51	0.75	0.67
8 This science teacher does not go over examination papers after they have been marked and does not discuss the results with us.	2.25	0.81	0.67
9. This science teacher does not use homework marks to find out if we need more help in understanding our work.	2.10	0.83	0.70
10 This science teacher asks questions around the class-room so that we cannot predict who is going to be asked.	2.19	0.81	0.71
11 This science teacher gives us a chance to do experi-ments by ourselves.	1.49	0.77	0.68
12 This science teacher does not like us asking him questions.	2.06	0.92	0.71
13 This science teacher moves from one subject to another before making sure that we all have understood the previous one.	1.97	0.93	0.70
14 This science teacher presents the main ideas in a lesson in a way that is easy to follow.	2.57	0.70	0.68
15 This science teacher finds different ways of teaching science to interest us in the subject.	2.23	0.74	0.67

(Continued Table 21)

Items	Mean	SD	α n-1
16 This science teacher asks more questions than are included in our textbooks.	1.82	0.86	0.70
17 This science teacher finished topics and experiments in good time before the end of lessons.	2.54	0.74	0.70
18 This science teacher spends too much time giving us facts, information instead of practical experimental work.	1.81	0.89	0.73
19 This science teacher does not ignore our ideas but makes use of them in discussions.	2.43	0.71	0.69
20 This science teacher invites and values various points of view from us.	2.38	0.78	0.67
21 This science teacher is very keen on what he/she teaches.	2.59	0.52	0.68
Total	2.39	0.77	0.66

5.1.2.1.1.3 TEACHER CLASSROOM PERSONALITY

For the scale of Teacher Classroom Personality items of the ISSPQ the results of the pilot-study shown in Table 22, indicate that the means of these items ranged between 1.31 to 2.52 and the standard deviations ranged from 0.85 to 0.66. The results of the pilot-study for alpha indicated that the alpha reliability of the whole scale items was very low 0.27.

Table 22 also shows the results of alpha reliability if item is deleted on at atime which showed that two items gave a sizable increase in reliability (items 5 and 7). Therefore, it is doubtful if this scale will be able to make a significant contribution to the current research.

Table 22

Means, Standard Deviations and Alpha if Item is deleted for Items Associated with Teacher Classroom Personality of ISSPQ (N=198).

Items	Mean	SD	αn-1
1 This science teacher notices when we are not paying attention or misbehaving and stops us.	2.46	0.81	0.23
2 This science teacher permits our discussions to wander too far of the subject	2.38	0.86	0.31
3 This science teacher very often comes late to the classroom.	2.44	0.84	0.14
4 This science teacher does not attend all his classes.	2.52	0.81	0.17
5 This science teacher does notice us cheating during lessons and in the examinations.	1.96	0.82	0.34
6 This science teacher permits us to show reasonable signs of humour.	2.20	0.85	0.17
7 This science teacher has a sense of humour.	2.36	0.76	0.35
8 We can depend on this science teacher to hold activities as planned.	2.33	0.75	0.17
Total	2.33	0.81	0.24

5.1.2.1.1.4 TEACHER CLASSROOM ATTITUDE

For the scale of Teacher Classroom Attitude items of the ISSPQ, the results of the pilot-study, shown in Table 23, indicate that the means of the whole items of this scale ranged from 2.23 to 2.53, standard deviations ranged from 0.92 to 0.69. The alpha reliability of the whole scale was 0.33.

Table 23 also provide the analysis of alpha reliability if item is deleted one at atime which indicated a big increase in two items (item 1 and 3). The low α values and the non homogeneity of two or more items again raises doubt about the usefulness of this scale.

Table 23

Means, Standard Deviation and Alpha if Item is deleted for Items Associated with Teachers' Classroom Attitude (N=198).

Items	Mean	SD	α n-1
1 This science teacher does not let personal problems interfer with his treatment of us.	2.30	0.78	0.40
2 This science teacher punishes the whole class when one or two of us do something wrong.	2.44	0.84	0.31
3 This science teacher does not make fun of us for giving wrong answers.	1.82	0.92	0.53
4 This science teacher does not make us feel he is proud of us.	2.03	0.82	0.19
5 This science teacher trusts and respects us.	2.47	0.73	0.17
6 This science teacher deducts marks from our work to punish us.	2.07	0.86	0.25
7 This science teacher is fair in marking assignments, homework and examinations.	2.53	0.69	0.19
8 This science teacher behaves in the same way towards all of us, regardless of how good we are in science.	2.11	0.84	0.24
Total	2.22	0.81	0.29

5.1.2.1.2 THE RELIABILITY OF THE ATSSA INSTRUMENT.

Table 24 gives details of the pilot study of the ATSSA instrument. It can be seen that the results of the pilot study for this particular instrument indicated that students' mean scores for the items on the ATSSA ranged from 3.21 to 4.01 and the standard deviation ranged from 0.92 to 1.23. The Cronbach alpha reliability was found to be 0.92 for the whole scale which is as high as might be expected and almost identical to the reliability of the original value of the instrument measured by the developer (alpha 0.93).

Table 24

Means, Standard Deviations and Alpha if Item is deleted for Items of the Attitude Towards Science in School Assessment (ATSSA) N=198.

Items	Mean	SD	αn-1
1 Science is fun.	3.96	1.14	0.912
2 I do not like science and it bothers me to have to study it.	3.92	1.10	0.918
3 During science class, I usually am interested	3.92	0.92	0.917
4 I would like to study more about science.	3.88	1.14	0.914
5 If I knew I would never go to science class I would feel sad.	3.21	1.16	0.916
6 Science is interesting to me and I enjoy it.	3.87	1.03	0.910
7 Science makes me feel uncomfortable, restless, irritable, and impatient.	3.57	1.23	0.918
8 Science is fascinating and fun.	3.67	1.06	0.915
9 The feeling that I have towards science is a good feeling.	3.76	1.01	0.912
10 When I hear the word science, I have a feeling of dislike.	4.01	1.05	0.916
11 Science is a topic which I enjoy studying.	3.83	1.02	0.91
12 I feel at ease with science and I like it very much.	3.68	1.11	0.91
13 I feel a definite positive reaction to science.	3.57	0.98	0.91
14 Science is boring.	3.88	1.18	0.91
Total	3.77	1.08	0.92

5.1.2.3 RELIABILITIES OF ATS, SAM AND SSCO SCALES.

The remainder of the research instruments, namely the Science Self-concept, Self-achievement Motivation and Attitude Towards School scales were administered twice prior to the main study in order to obtain test-retest data. On both occasions the 3 scales were administered in one instrument.

A sample of 34 students age 14^+ years was chosen from two classes from one intermediate school in an urban area.

Students were told about the purpose of the study. They were also given full written instructions on how to answer items. Although directions were written to make it easier for the students and to save time, the researcher directed students as to how to answer items and examples were given in writing and through demonstration. Students were requested to seek help if they faced any difficulty in reading any item of the instruments.

The instrument, which consisted of three items of the "Attitudes Towards School", four items of "Self-achievement Motivation", two items of the "Science Self-concept", was distributed to the students and the directions and research purpose were fully described. The first-stage results of the "Attitude Towards School", "Self-achievement Motivation" and "Science Self-concept" were coded. A week later the same tests were given to the same sample and again these results were coded.

The results of these test-retest analyses are shown in Table 25. The values of the means and standard deviations indicate that all three instruments are stable over time. The reliabilities were the same in both cases.

Table 25

Test-Retest Reliability Values of Instruments from Initial Pilot Study (N=34).

Scale	Test Mean	SD	RE-TEST Mean	SD	Reli. Value
Attitude Towards School					
1 Most teachers at this school are fair with students.	3.56	0.99	3.44	0.99	0.84
2 I am under great pressure at school.	3.97	1.11	4.09	0.90	
3 I feel like I have little control over what happens to me at school.	3.68	1.25	3.68	1.09	
Self-Achievement Motiva.					
1 I always try hard, matter how difficult the work.	4.18	0.94	4.18	0.90	0.83
2 When I fail, that makes me try that much harder.	4.53	0.79	4.38	0.99	
3 I always try to do my best in school.	4.29	0.72	4.29	0.68	
4 I try hard to do well in science.	3.59	1.18	3.82	0.76	
Science Self-Concept					
1 I consider myself a good science student.	3.94	0.69	4.15	0.86	0.86
2 I think I am capable of becoming an engineer doctor.	3.62	0.92	3.50	1.13	

5.1.2.4 THE RELIABILITY OF THE STUDENT SCIENCE ACHIEVEMENT TEST

This instrument was designed by the researcher with the help of others as indicated in chapter 4. It was important to have this instrument tested to clear any ambiguities, remove ineffective distractors and eliminates any other technical defects that may have been missed during the test preparation.

The items of the science achievement test were item-analysed for alpha if item was deleted and alpha reliability.

The results of the science achievement test indicated that the mean of students responses to items of the science achievement test ranged from 0.15 to 0.98 with the standard deviation ranging from 0.23 to o.50, see Table 26. The alpha reliability for the whole test which consisted of 36 items was 0.72.

The column $\alpha n-1$ indicates that no item need to be deleted from the test.

5.1.2.4.1 THE STANDARD ERROR OF MEASURMENT

The previous forms of reliability used in this study was to give an overal estimate of test consistency that is very useful in comparing different tests that an individual may want to consider for use in research project. However, for interpreting test scores, the

Standard Error of Measurement is more useful tool. An individual score is likely to contain a certain amount of measurment errors. The Standard Error of Measurment allows you to estimate the range within which the individual's true score probably falls. Therefore, the Standard Error of Measurement is regarded as an index of a test's reliability.

To measure the standard error of measrement (S_m) the following formula is used:

$$S_m = SD \sqrt{1-r}$$

Where SD the Standard Deviation

r is the reliability of the test

Since Sm is normally distributed, we can estimate the probability that an error of a given size will occur. In this part it is important to know that about two-thirds of all test scores will be within plus or minus one standard error of measurement of their true score and about 95 percent will be within + two S_m. For the science achievement test used in this study the Standard Error of Measurement is calculated as follow:

$SD = 4.76$

$r = 0.72$

Applying the previous equation we get

$S_m = 4.76 \sqrt{1 - 0.72}$

$S_m = 4.76 \sqrt{0.28}$

$S_m = 2.52$

To illustrate the calculation of the Standard Error of Measurement for the Science achievement test, if a student obtains a sore of 25 on the science achievement test, there would be 2 chances in 3 that the true score would be between 20.48 and 29.52 (i.e., 25 + 2.52); and 95 chances in 100 that the student's true score would lie between 25 + 2 X 2.52 (25 + 5.04 or 19.96 and 30.04).

It is clearly from the formula that the size of Sm is inversely related to the reliability coefficient; that is, as the reliability becomes higher, the error becomes smaller.

Standard Error of Measurement helps us to understand that the scores we obtain on educational tests are only estimates and can be considerably different from the individual's "true score." .

Table 26

Means, Standards Deviation and Alpha if item is deleted of the Stdent Science Achievement Test (N=132).

Items	Mean	SD	α n-1
1	0.92	0.25	0.72
2	0.43	0.50	0.72
3	0.86	0.33	0.72
4	0.94	0.23	0.72
5	0.92	0.47	0.72
6	0.67	0.46	0.71
7	0.57	0.50	0.72
8	0.55	0.50	0.71
9	0.77	0.46	0.73
10	0.71	0.41	0.73
11	0.86	0.35	0.72
12	0.61	0.50	0.71
13	0.59	0.49	0.71
14	0.61	0.50	0.71
15	0.33	0.49	0.71
16	0.79	0.41	0.71
17	0.63	0.48	0.71
18	0.89	0.30	0.71
19	0.98	0.43	0.72
20	0.70	0.44	0.72
21	0.62	0.49	0.72
22	0.27	0.50	0.72
23	0.58	0.37	0.73
24	0.53	0.50	0.73
25	0.58	0.48	0.71
26	0.83	0.32	0.71
27	0.78	0.43	0.72
28	0.16	0.48	0.73
29	0.75	0.39	0.71
30	0.75	0.41	0.71
31	0.60	0.47	0.71
32	0.80	0.42	0.71
33	0.61	0.47	0.71
34	0.45	0.50	0.72
35	0.58	0.50	0.70
36	0.70	0.45	0.72
Total	0.66	0.44	0.72

5.3 SUMMARY OF PILOT STUDY FINDINGS AND DECISION TAKING

Results from the pilot study test of the instruments are shown in Tables 20-26 inclusive.

Some scales are reliable and may be used in their present form without comment. These are ATSSA, ISSPQ (Pre-classroom behaviour and Classroom Behaviour), ATS, SAM and SSC and the Science Achievement Test. However, two scales have less reliability and their contribution to the research (main study) has to be questioned. These scales are Teacher Classroom Personality and Teacher Classroom Attitudes.

There are three possibilities:

1. To drop the scales, ie., to omit measurments on these concepts from the study.

2. Replace scales with others. There is limited time for the research to be completed and limited time was provided by schools and the local education authorities before the start of the school holidays. It was, therefore, impossible to locate and test alternative scales.

3. Use the scales in their present form and if they continued to show the same low reliability not include them in the main results calculations.

Thus, the latter possible was chosen which means to postpone making decision at this stage.

CHAPTER SIX

SAMPLING AND RESULTS

6.0 INTRODUCTION

This chapter is divided into six parts, describing in turn, **Part One**, the sample of the main study; **Part Two**, the reliabilities of the instruments with the main sample, **Part Three**, data analyses of School and Teacher, Student and Home variables scales; **Part Four**, description of Student Perceptions of their Science Teachers in the third year of the intermediate school in Southwestern Saudi Arabia; **Part Five**, correlations of the main study variables; and **Part Six**, regression analyses using various sets of independent variables to predict Student Science Achievement and Attitude Towards Science.

PART ONE

SAMPLING DESCRIPTIONS

6.1 SAMPLE FOR THE FIELD WORK OF THE MAIN STUDY

As indicated in Chapter One the expansion in educational development in Saudi Arabia has led to an increase in the number of schools which open every year.

To conduct the main study, permission had to be obtained from the Ministry of Education to approach each

LEA Director, then to contact the supervisors who allocate the school students within each Zone of a Local Education Authority. Schools were then chosen at random for study within a LEA.

As far as the Southwest region of Saudi Arabia is concerned, there are 460 intermediate schools (ME, 1989) distributed among 13 local education authorities. All intermediate schools, in these educational authorities, enrolling only males were considered the target population for this study. Table 27 shows the number of intermediate schools and the number of students in each local education authority in Southwest Saudi Arabia. As shown in Table 27 the data collected personally from the local education authorities included the number of schools, classes, students, third-year classes and third-year students in the seven local education authorities.

For the selection of subjects, four intermediate schools were randomly chosen from each of seven of the 13 local education authorities in the Southwest of Saudi Arabia. All classes from the same year group in each of the chosen schools were used and all third-year students were requested to participate in the study.

This study occurred at a difficult time because data collection came during the Gulf war during which many students from the neighbouring countries left with their parents; this had an effect on the total number of the students who participated in the study. Also, three schools had to be left out from the main study which left 25 schools. Few students completed the whole set of questionnaires in two schools whilst in the third the science teacher had changed at the beginning of the second term which would have made it difficult for students to give their perception.

Therefore, the final sample number for the study consisted of a total of 1129 students aged 15^+ years in 25 schools.

The final sample used in the main study is shown in Table 28. This Table includes the number of intermediate schools, number of third-year classes, and number of students and teachers which actually participated in the final study without calculating absentees and the non-suitability of some of the returned questionnaires for the final analysis.

Table 27

Number of Schools, Classes, Students and Number of Third-Year Students in Each Local Education Authority .

L.E.A	Schools	Classes	Student	3rd Year Classes	3rd Year Students
Abha	65	380	10529	119	3002
Al-Bahah	54	259	6046	791	748
Bish	67	252	5208	94	1361
Gizan	*	*	*	*	*
Muhail A.	37	160	3606	45	920
Najran	40	229	5920	*	*
Sabia	78	323	7113	80	1675

* Data were not available. Source was self-collected data

All the twenty five schools were male. There were no records of I.Q. tests for any of the schools and there was no evidence of streaming. All the schools, therefore, contained mixed-ability students.

Table 28

The Number of Schools, Classes, Students, and Teachers Covered by the Study in the Seven Local Education Authorities.

L.E.A	Schools	Classes	Students	Teachers
Abha	3	7	178	3
Al-Baha	4	9	226	5
Bishah	4	7	181	5
Gizan	3	7	247	4
Najran	4	9	223	5
Muhail A.	3	8	196	3
Sabia	4	7	205	4
Total	25	54	1456	29

6.1.1 THE CHARACTERISTICS OF THE SELECTED SCHOOLS

The main study sample included schools from urban, and rural areas in the region.

Table 29 shows the regional status of each local education authority and each school in terms of whether it is urban or rural. It can be seen from Table 28 that 7 schools were from urban areas, and 18 schools were from rural areas. Table 29 also gives the numbers of students and classes in each school.

Table 29

Regional Status and Number of Students and Classes Participating in the Final Study.

LEA	Number of Classes Urban	Rural	Number of Students Urban	Rural
Abha	5	2	119	57
Al-Baha	2	7	57	142
Bishah	4	3	53	93
Gizan	3	4	52	82
Muhail A.	3	6	62	130
Najran	7	-	153	-
Sabia	2	5	34	95
Total	26	27	530	599

6.1.2 ADMINISTRATION OF THE STUDY INSTRUMENTS

When the schools were chosen and permission to visit each school had been obtained from the supervisors of each local education authority, the schools were approached.

On arrival at each school, the written permission was delivered to the Principal who introduced the researcher to the science teacher(s) in charge of the third year of the intermediate school. After a meeting during which the purpose of the research was explained to the teacher(s), the students were asked to assemble in a classroom, if they did not have a science lesson at the time of the visit.

The teacher was given the teacher questionnaire and asked to leave the classroom, while the ISSPQ and the other tests were administered to students. The same procedures and instructional details, as used in the Pilot Study (See Chapter 4), were used in administering the same materials in the Main Study.

Occasionally, students asked for help in interpreting some of the statements on the ISSPQ and the other tests. When such a request was made, care was taken to clarify the statement without implying any answers. There was no time limit and each student was asked to respond to all statements and all questionnaires.

The whole set of the study questionnaires took 30-80 minutes to be completed by students.

The sample includes Saudi and non-Saudi teachers with different teaching qualification. The non-Saudi teachers were from neighbouring Arab countries of Sudan, Jordan, Egypt and Syria. The student sample included non-Saudi students mainly from Yemen, Syria, Jordan, Egypt, Palestine, Sudan Somalia and Kuwait.

The characteristics of the teachers are reported more fully in the next section.

PART TWO

DATA ANALYSIS & RESULTS

THE RELIABILITIES OF THE INSTRUMENTS WITH THE MAIN SAMPLE

This part reports the reliability of the rating instruments used in this study as described in chapter 4. Although confidence is built from the reliability of this study's instruments as reported in the pilot study (chapter 5), it is necessary to report also the reliabilities of the instruments (i.e., ATTSSA, ISSPQ, ATS, SAM, SSC and the SAT) when used the main sample of this study.

The analyses procedures used with the pilot study were followed.

6.2.1 THE RELIABILITY OF ISSPQ

This part reports the reliabilities of the ISSPQ scales with the main sample.

6.2.1.1 TEACHER PRE-CLASSROOM BEHAVIOUR

Table 30 gives the results of the Teacher Pre-Classroom Behaviour items of the ISSPQ. The mean of the items ranged from 2.30 to 2.79 while their standard deviations ranged from 0.49. to 0.85. For the alpha reliability for the seven items of the teacher pre-classroom behaviour was 0.66 a little less than the value obtained in the pilot study.

Regarding alpha if item was deleted, it is seen that items 1, 2 and 7 had high alpha values (less homogenous) but in general all items are homogeneous and adequate.

Table 30

Means, Standard Deviations and Alpha if Item is deleted for Items Associated with Teachers' Pre-Classroom Behaviour of ISSPQ.

Items	Mean	SD	αn-1
1 This science teacher knows the subject very well.	2.79	0.49	0.65
2 This science teacher presents the main ideas in an organised and integrated way.	2.72	0.62	0.65
3 This science teacher makes adequate plans for the laboratory activities.	2.48	0.77	0.61
4 This science teacher conducts the laboratory activities confidently.	2.64	0.66	0.59
5 This science teacher collects all the necessary materials for laboratory activities.	2.30	0.83	0.62
6 This science teacher carries out laboratory activities successfully.	2.65	0.85	0.60
7 This science teacher gives satisfactory explanations to students' questions.	2.60	0.73	0.66
Total	2.60	0.55	0.63

6.2.1.2 TEACHER CLASSROOM BEHAVIOUR

For the scale of Teacher Classroom Behaviour, the descriptive statistics and the reliability of this scale using the main sample are presented in Table 31. These results indicated that the mean for teacher classroom-behaviour items of ISSPQ ranged from 2.52 to 2.73 and their standard deviations ranged from 0.57 to 0.94. Table 31 also shows details of alpha if item was deleted which, again, indicate only a modest gain in reliability from omission of any of several items. Only one item provides a big increase in the reliability and that is item 18 (as in the pilot study). For alpha reliability with the main sample the value was 0.66 which is the same value obtained with the the pilot study.

Table 31

Means, Standard Deviations and Alpha if item is deleted of Items Related to Characteristics Associated with Teacher Classroom Behaviour of ISSPQ (N=1129).

Items	MEAN	SD	αn-1
1 This science teacher uses simple and clear words when explaining a lesson.	2.69	0.67	0.67
2 This science teacher asks questions during a lesson to hold our attention.	2.73	0.63	0.67
3 This science teacher gives us a chance or a clue when answering questions.	2.65	0.71	0.67

(Continued Table 31)

Items	Mean	SD	α n-1
4 This science teacher uses enough audio-visual and living and non-living aids to make a lesson clear.	2.01	0.91	0.67
5 This science teacher asks questions during practical work to make sure we understand what he is doing.	2.66	0.69	0.66
6 This science teacher asks questions at the end of each lesson.	2.36	0.90	0.66
7 This science teacher summarises and goes over the main ideas of a lesson before the end.	2.58	0.77	0.66
8 This science teacher does not go over examination papers after they have been marked and does not discuss the results with us.	2.37	0.87	0.67
9 This science teacher does not use homework marks to find out if we need more help in understanding our work.	2.25	0.88	0.68
10 This science teacher asks questions around the classroom so that we cannot predict who is going to be asked.	2.40	0.83	0.68
11 This science teacher gives us a chance to do experiments by ourselves.	1.52	0.82	0.67
12 This science teacher does not like us asking him questions.	2.64	0.70	0.66
13 This science teacher moves from one subject to another before making sure that we all have understood the previous one.	2.59	0.76	0.66

(Continued Table 31)

Items	Mean	SD	α n-1
14 This science teacher presents the main ideas in a lesson in a way that is easy to follow.	2.59	0.76	0.64
15 This science teacher finds different ways of teaching science to interest us in the subject.	2.46	0.82	0.64
16 This science teacher asks more questions than are included in our textbooks.	2.07	0.94	0.69
17 This science teacher finishes topics and experiments in good time before the end of lessons.	2.55	0.79	0.67
18 This science teacher spends too much time giving us facts, information instead of practical experimental work.	2.08	0.94	0.70
19 This science teacher does not ignore our ideas but makes use of them in discussions.	2.65	0.70	0.66
20 This science teacher invites and values various points of view from us.	2.57	0.74	0.66
21 This science teacher is very keen on what he/she teaches.	2.73	0.56	0.67
Total	2.3	0.75	0.66

6.2.1.3 TEACHER CLASSROOM PERSONALITY

For the scale of Teacher Classroom Personality items of the ISSPQ the results of the main study descriptive statistics and the reliability are shown in Table 32. The means ranged between 2.11 to 2.79 with the average of 2.52, the standard deviations ranged from 0.55 to 0.89 and the reliability of this scale was 0.31. The result of this scale reliability gives a clear indication that this scale should not be used because the items were not homogenous. The scale has too few items to allow some items to be removed.

Table 32

Means, Standard Deviations and Alpha if item is deleted for Items of the ISSPQ Associated with Teacher Classroom Personality (N=1129).

Items	Mean	SD	α n-1
1 This science teacher notices when we are not not paying attention misbehaving and stops us.	2.60	0.73	0.33
2 This science teacher permites our discussions to wander too far of the subject.	2.55	0.76	0.31
3 This science teacher very often comes late to the classroom.	2.67	0.68	0.30
4 This science teacher does not attend all his classes.	2.79	0.55	0.32
5 This science teacher does notice us cheating during lis-sons and in the examinations.	2.11	0.89	0.33
6 This science teacher permits us to show reasonable signs of humour.	2.36	0.85	0.34
7 This science teacher has a sense of humour.	2.53	0.75	0.31
8 We can depend on this science teacher to hold activities as planned.	2.36	0.83	0.27
Total	2.52	0.76	0.31

6.2.1.4 TEACHER CLASSROOM ATTITUDES

For the scale of Teacher Classroom Attitude items of the ISSPQ, the results of the descriptive statistics and the reliability using the main sample are shown in Table 33. The mean ranged from 2.11 to 2.79 with the average mean of 2.4, standard deviations ranged from 0.90 to 0.57. Table 33 also provides the results of alpha if item was deleted which again raise doubt about the possibility of using this scale in the final analysis. For the alpha reliability for the whole items of this scale is **0.40**. This is a low reliability which gives indication that the items are not homogenous and this scale cannot be used.

Table 33

Means, Standard Deviation and Alpha if Item was deleted for Items of the ISSPQ Associated with Teachers' Classroom Attitude (N=1129).

Items	MEAN	SD	α n-1
1 This science teacher does not let personal problems interfere with his treatment of us.	2.48	0.78	0.38
2 This science teacher punishes the whole class when one or two of us do something wrong.	2.60	0.74	0.42
3 This science teacher does does make fun of us for giving wrong answers.	2.43	0.86	0.37
4 This science teacher does not make us feel he is proud of us.	2.12	0.90	0.37
5 This science teacher trusts and respects us.	2.59	0.71.	0.32
6 This science teacher deducts marks from our work to punish us.	2.23	0.87	0.39
7 This science teacher is fair in marking assignments, homework and examinations.	2.75	0.57	0.33
8 This science teacher behaves in the same way towards all of us, regardless of how good we are in science.	2.48	0.79	0.37
Total	2.45	0.78	0.40

6.2.2 THE RELIABILITIES OF THE ATSSA INSTRUMENT.

Table 34 gives details of the descriptive statistics and alpha reliability if item is deleted of the main sample for the ATSSA. It can be seen that the results of this particular instrument indicated that students' mean scores for the items on the ATSSA ranged from 3.42 to 4.04 with a mean of 3.79 and the standard deviation ranged from 0.96 to 1.32. The alpha Cronbach Reliability was found to be 0.88 for the whole scale which is only slightly less than the reliability with the pilot study sample (0.92) and of the reliability found when the original American version. This is an acceptable result in view of the change in culture, educational system and even curriculum.

Table 34

Means, Standard Deviations and Alpha if item is deleted for Items of the Attitude Towards Science in School Assessment (ATSSA) N=1129.

Items	Mean	SD	αn-1
1 Science is fun.	3.87	1.17	0.87
2 I do not like science and it bothers me to have to study it.	3.79	1.12	0.878
3 During science class, I usually am interested	4.04	0.96	0.875
4 I would like to study more about science.	3.98	1.13	0.872
5 If I knew I would never go to science class I would feel sad.	3.42	1.26	0.879
6 Science is interesting to me and I enjoy it.	3.94	1.09	0.87
7 Science makes me feel uncomfortable, restless, irritable, and impatient.	3.63	1.20	0.878
8 Science is fascinating and fun.	3.69	1.24	0.87
9 The feeling that I have towards science is a good feeling.	3.87	1.10	0.869
10 When I hear the word science, I have a feeling of dislike.	3.81	1.14	0.876
11 Science is a topic which I enjoy studying.	3.80	1.10	0.865
12 I feel at ease with science and I like it very much.	3.80	1.13	0.86
13 I feel a definite positive reaction to science.	3.72	1.09	0.878
14 Science is boring.	3.69	1.32	0.876
Total	3.79	1.15	0.88

6.2.3 THE RELIABILITY OF ATTITUDE TOWARDS SCHOOL, SELF-ACHIEVEMENT MOTIVATION AND SCIENCE SELF-CONCEPT.

This part reports the descriptive statistics and the reliability of the Attitude Towards School, Self-achievement Motivation and Science Self-concept scales.

The results of the descriptive statistics and the reliability of the three scales are shown in Table 35. For the Attitude Towards School scale indicated that the mean ranged from 3.78 to 3.85 with the average of 3.81, and the standard deviation ranged from 1.10 to 1.16 and the alpha reliability for the whole scale was 0.61. Although the alpha was not very strong for the scale, value is greater than the alpha found by the original constructor of the instrument as shown in chapter four.

For the scale of self-achievement motivation the mean ranged from 4.64 to 4.04 with average of 4.04, standard deviation ranged from 0.92 to 1.13 while alpha for the whole scale was 0.58. Although this reliability is a little lower than that found in the original research, it is quite acceptable considering the differences in national culture and the school curriculum between the USA and Saudi Arabia.

For the science self-concept scale which was of two items, the mean, were 3.42 and 3.72 with the average of 3.57, the standard deviation was 1.13 and 1.12 with the alpha reliability of 0.48 for the whole scale, for the scale of two items, no α_{n-1} is calculated.

These three scales are attitudinal and designed to measure some of the students personality and they share the same rating system as already explained in chapter four they also deal with similar ideas, for example item 2 of the Attitude Towards School and item 4 of the Self-achievement Motivation. It was thought that combining the three scales and to make them one scale could be beneficial and will ease the final analysis.

When these scales were item analysed as one scale the alpha reliability was far better than the alpha for each single scale and the alpha if item was deleted was better and showing homogenity than with the single scale. Table 36 provides full details of this new scale which called the School Achievement Motivation (SAM).

It is interesting that the nine items are all homogeneous in the new scale the alpha value of 0.69 is comparable with that of other Attitudinal scales used in this study and elsewhere.

Table 35

Mean, Standard Deviation and Alpha if item is deleted and the reliability of the Attitude Towards School, Self-Achievement Motivation, Science Self-Concept Questionnaire, (N=1129).

Scale	Mean	SD	α n-1	α Sc.
Attitude Towards School				
1 Most teachers at this school are fair with students.	3.78	1.16	0.73	0.61
2 I am under great pressure at school.	3.85	1.14	0.38	
3 I feel like I have little control over what happens to me at school.	3.79	1.10	0.35	
Self Achievement Motivation				
1 I always try hard, matter how difficult the work.	4.04	0.99	0.52	0.58
2 When I fail, that makes me try that much harder.	4.29	0.97	0.50	
3 I always try to do my best in school.	4.21	0.92	0.45	
4 I try hard to do well in science.	3.64	1.13	0.56	
Science Self-Concept				
1 I consider myself a good science student.	3.72	1.13		0.48
2 I think I am capable of becoming an engineer doctor.	3.42	1.12		

Table 36

Mean, Standard Deviation and Alpha if item is deleted and the reliability of the School Achievement Motivation (SAM), (N=1129).

Items	Mean	SD	α n-1
1 Most teachers at this school are fair with students.	3.78	1.16	0.67
2 I am under great pressure at school.	3.85	1.14	0.67
3 I feel like I have little control over what happens to me at school.	3.79	1.10	0.66
4 I always try hard, matter how difficult the work.	4.04	0.99	0.66
5 When I fail, that makes me try that much harder.	4.29	0.97	0.67
6 I always try to do my best in school.	4.21	0.92	0.66
7 I try hard to do well in science.	3.64	1.13	0.68
8 I consider myself a good science student.	3.72	1.13	0.66
9 I think I am capable of becoming an engineer doctor.	3.42	1.12	0.67
Total	3.86	1.07	0.67

6.2.4 THE STUDENT SCIENCE ACHIEVEMENT TEST

As reported in Chapter Five, the whole science achievement test was used in the main study.

The results of the main study sample indicated (Table 37) that the means and item standard deviations for the whole sample ranged from 0.19 to 0.97 and 0.18 to 0.50 respectively. The alpha reliability for the 36 items of the whole test was 0.77. Items 2, 30, 31 and 32 were deleted; item 2 because it was very difficult for students (only 19.8% of the whole sample answered the question correctly). Items 30, 31 and 32 were deleted by order from the Ministry of Education (July, 1991) who decided that due to the short period of the term some topics should be deleted. The result of the reliability testing is shown in Table 37 the reliability of the 32 items was 0.77 here n_{-1} values show the scale was homogeneous which therefore means that there is no need to delete any further items of the Science Achievement Test.

6.2.4.1 THE STANDARD ERROR OF MEASUREMENT

The same procedure mentioned in page 159 of Chapter Five is repeated in this part but the figures obtained for the main study look slighty different from those obtained in the pilot study. In the main study

$SD = 4.66$ and $r = 0.77$

Table 37

Means, Standard Deviation and Alpha if item is deleted of the Science Achievement Test (N=1129).

Item	Mean	S.D	α n-1	α n-1 **
1	0.92	0.26	0.78	0.77
2	0.19	0.39	0.78	-
3	0.82	0.38	0.78	0.77
4	0.94	0.22	0.77	0.765
5	0.89	0.31	0.77	0.76
6	0.79	0.40	0.77	0.758
7	0.61	0.48	0.76	0.76
8	0.57	0.49	0.77	0.76
9	0.77	0.41	0.77	0.766
10	0.75	0.43	0.77	0.764
11	0.86	0.34	0.77	0.76
12	0.74	0.44	0.77	0.74
13	0.69	0.46	0.77	0.769
14	0.60	0.49	0.77	0.759
15	0.49	0.50	0.77	0.76
16	0.84	0.36	0.77	0.76
17	0.72	0.45	0.77	0.766
18	0.86	0.35	0.77	0.77
19	0.96	0.18	0.78	0.765
20	0.87	0.33	0.77	0.76
21	0.57	0.49	0.77	0.768
22	0.51	0.50	0.77	0.765
23	0.66	0.47	0.77	0.77
24	0.87	0.33	0.78	0.76
25	0.52	0.50	0.77	0.76
26	0.81	0.38	0.77	0.76
27	0.75	0.43	0.77	0.77
28	0.91	0.29	0.78	0.76
29	0.76	0.42	0.77	0.76
30	0.75	0.43	0.77	-
31	0.79	0.40	0.77	-
32	0.55	0.49	0.77	-
33	0.52	0.50	0.77	0.766
34	0.53	0.50	0.78	0.768
35	0.82	0.38	0.77	0.767
36	0.64	0.48	0.77	0.76
Total	25.84	4.66	0.77	0.76

** Scale after deletion of items 2, 30, 31 and 33 (See text).

$$S_m = 4.66\sqrt{1 - 0.77} \quad = 2.23$$

Further details for the instruments are reported in Appendix B for the ATSSA, ISSPQ, SAM and SSAT.

6.2.5 SUMMARY OF PART TWO.

This part has reported the reliabilities of the main instruments used in the main part of this study; the results are fully described in Tables 30-37.

Two of these (Teacher Pre-classroom Behaviour and ATSSA) instruments had slightly lower reliability values than the values obtained in the pilot study one instrument had a small increase in its alpha reliability (Science Achievement Test). Doubt is still raised regarding the use of Teacher Classroom Personality and Teacher Classroom Attitude which their alpha reliability values and alpha if item was deleted were poor for both scales. One additional instrument was created from previously reported scales and that is SAM (School Achievement Motivation) which had a satisfactory alpha value. This one scale replaces the three Attitude Towards School, Self-achievement Motivation and Science Self-concept scales.

PART THREE

RESULTS OF THE MAIN STUDY RELATED TO TEACHER STUDENT AND HOME

This section examines results of some of the instruments seeking data about teacher, student and home characteristics. It also includes analyses of some of the results concerned with the main study questions reported in Chapter Four.

Although the main aim here is to find significant correlations between teacher, student and home variables and student achievement in and attitude towards science, it is useful to look at some descriptive statistics before exploring these relationships.

6.3.1.1 TEACHER VARIABLES AND CHARACTERISTICS

This part is concerned with descriptive statistics of teacher variables of Age, Teaching Experience, Qualification, Teaching Load and Classroom Size.

6.3.1.1.1 TEACHER AGE

From Table 38 it is clear that most of the intermediate male science teachers in this study were between 31-35 years old, while only three teachers

(10.34%) were over 41 years old, and another three were less than 25 years old. This means that the latter were relatively new to the teaching profession. Eight teachers (20.7%) of the sample were aged between 26-30 years, and 4 teachers (13.8%) were aged between 36-40 years.

Table 38

Frequencies and Percentages of Teachers' Ages in the Sample of the study.

Teacher's age	Frequency	Percentage
Less than 25	1	3.4
26-30	8	20.7
31-35	13	44.83
36-40	4	13.8
More than 41	3	10.34
Total	29	100

6.3.1.1.2 TEACHING EXPERIENCE

Table 39 shows that most of the male science teachers in the sample (38%) had 5-10 years science teaching experience, while 24.1% and 17.2% had science teaching experience of 10-15 and 3-5 years respectively. Five teachers (17.2%) of the sample had less than 3 years of science teaching experience and one teacher had taught science for more than 20 years. Most of the sample had at least 3 years of experience. It is likely that, for most of these teachers, their teaching behaviour would have been well established.

Table 39

Frequencies and Percentages of Teacher Experiences in Teaching Science.

Experience	Frequency	Percentage
Less than 3	5	17.2
3-5	5	17.2
5-10	11	38
10-15	7	24.1
15-20	0	0
20-25	1	3.4
Total	29	99.9

Another analysis was the cross-tabulation of teacher age and the teaching experience. This was done by classifying teacher age into five groups as seen in Table 38, similarly teaching experience was classified into five groups. When this analysis was executed the pattern of results in Table 40 confirm the expected indicated that there is relationship between teacher's age and teaching experience, teachers who are older have more teaching experience.

Table 40

Cross-Tabulation of Teacher Age and Teaching Experience.

Teacher's Age	Teaching Experience				
	1 3	2 3-5	3 5-10	4 10-15	5 20-25
1 (Less than 25)	3				
2 (26-30)	1	5	1		
3 (31-35)	1	1	7	3	
4 (36-40)				4	
5 (More than 41)				2	1
Total Percentages	5 (17.2)	6 (20.7)	8 (27.6)	9 (31)	1 (3.4)

6.3.1.1.3 QUALIFICATIONS OF SCIENCE TEACHERS

The provision of science teachers in Saudi Arabia is quite a different issue from that of other countries. Teachers in Saudi Arabia may teach science to grades 7, 8 and 9 without a degree in science and education and some teachers may teach science with a degree in science, but have little or no preparation in teaching.

Science teachers have to be prepared differently from teachers of other subjects such as history and languages. Science teaching requires a wide range of instructional methods, which are applied to specific science subjects such as biology, chemistry and physics and often to particular topics. Therefore, it is of interest to discover the range of qualifications of science teachers in Saudi Arabia.

The results in Table 41 show that there were no teachers in the sample who possessed a Master Degree.

It can also be seen from Table 41 that only four teachers, 13.7%, had obtained a combined degree in Science and Education specialising in chemistry and physics, while 2 teachers, 6.9%, had obtained a combined degree with chemistry and biology. The majority of these male science teachers had obtained a science and education degree in biology.

Table 41

Frequencies and Percentages of Teachers' Qualifications.

Qualification		Freq.	%
Master in Education		0	0
Master in Science		0	0
B.Sc & Education;	Chemistry & Physics	4	13.7
	Chemistry & Biology	2	6.9
	Physics	0	0
	Chemistry	4	13.7
	Biology	11	38
Bachelor of Science;	Physics	0	0
	Chemistry	0	0
	Biology	0	0
Teaching Diploma;	Physics	2	6.9
	Chemistry	2	6.9
	Biology	2	6.9
BSc. in related Science Subject		2	6.9
Total		29	100

Teachers who had a Teaching Diploma were found to be evenly distributed among the sciences, i.e., chemistry, physics and biology; 2 teachers of each subject, 9.6%. Lastly, two teachers, 6.9%, had a Bachelor of Science in areas other than the traditional science subjects of chemistry, physics and biology. These were in astronomy and agriculture.

6.3.1.1.4 TEACHING LOAD

Teaching load has often been regarded as a vital factor associated with the effectiveness of a teacher. Teachers who have fewer teaching lessons each week in their time table are likely to have more spare time for preparing lessons, activities and scientific materials than other teachers who are somewhat overloaded.

In this study teachers were asked to state the number of lessons they undertook each week. The results are given in Table 42.

Three teachers, 10.3 %, indicated that they had fewer than 15 lessons every week, while 4 teachers, 13.8 %, taught between 15 and 19 lessons every week. About half of the sample, 14, or 48.3 %, taught between 20 and 24 science lessons every week. Eight teachers, however, taught more than 24 science lessons every week.

Table 42

Frequencies and Percentages of Science Teaching Loads (Number of Lessons/Week).

Science Lessons	Frequency	Percentage
Less than 15	3	10.3
15-19	4	13.8
20-24	14	48.3
More than 24	8	27.6
Total	29	100

6.3.1.1.5 CLASSROOM SIZE

Teachers were also asked to give the average number of students in their science classes. The results indicated that 5 teachers, 17.2%, taught classes containing 16 to 20 students, while 7 teachers, 24.1%, answered that they taught science classes of between 21 to 25 students, as shown in Table 43.

From Table 43, 34.5% of teachers taught science classes of between 26 and 30 students, while 6 teachers, 20.7 %, put the average number of students in their science classes as between 31 and 35. Finally, only one teacher, 3.4 %, claimed to teach science classes with an average size of between 36 and 40 students.

Thus, large classes seem to be an important feature of science teaching in Southwest Saudi Arabia as 58.6% had science classes of over 25 students; indeed about one-quarter of classes had more than thirty students in them.

Table 43

Frequencies and Percentages of Class Size (Number of Students in Each Class).

Class Size	Frequency	Percentages
16-20	5	17.2
21-25	7	24.1
26-30	10	34.5
31-35	6	20.7
36-40	1	3.4
Total	29	99.9

It is very interesting to undertake a cross-tabulation analysis to find the extent of the relationships between classroom size and teaching load. In other words, are teachers who have more science lessons teaching smaller classes? In order to undertake this analysis teachers had to be grouped into four groups according to their teaching load and into five groups according to their classroom size.

The results in Table 44 indicated that there is no clear relationship between teaching load of science teacher and their classroom size.

Table 44

The Cross-tabulation Analysis for Teaching Load and Classroom Size.

Class Size	Teaching Load				
	15	15-19	20-24	24	
1 16-20	1	2	1	2	6 (20.7)
2 21-25		1	2	3	6 (20.7)
3 26-30	1	1	5	5	12 (43.4)
4 31-35			3	1	4 (13.8)
5 36-40			1		1 (3.4)
Total	2	4	12	11	29 (100.00)

6.3.1.1.6 TEACHERS' OPINIONS OF THEIR INTEGRATED SCIENCE CURRICULUM

It is very important to know teachers' satisfaction with the curriculum they teach. Teachers who are satisfied with what they are expected to do are more likely to find teaching and conducting lesson activities much easier. In this study, teachers were asked to state their opinion about their science curriculum. This issue was targeted because the general impression among educationists and teachers in Saudi Arabia, about not only the science curriculum in intermediate and secondary schools but the whole school syllabus, is that it is over-loaded.

The concern here was to investigate this phenomenon related to the science curriculum in the third year only. Therefore, teachers were asked to rate their opinion in four different categories: easy; easy and over-loaded; difficult; and difficult and over-loaded.

The results in Table 45 show that 22 teachers, 73.9%, agreed that the third-year science curriculum was easy and over-loaded. Six teachers, 21.7%, have agreed that the third-year intermediate school science curriculum was easy. Only one teacher, 3.4%, responded that the third-year science curriculum was difficult and over-loaded.

Table 45

Frequencies and Percentages of Teachers' Opinions of their Third-year Integrated science curriculum.

Opinion	Frequency	Percentages
Easy & Over-loaded	22	73.9
Easy	6	21.7
Difficult & Over-loaded	1	3.4
Total	29	100

6.3.1.1.7 AVAILABILITY OF SCIENCE MATERIALS IN INTERMEDIATE SCHOOLS OF SOUTHWEST SAUDI ARABIA

If science lessons are to be presented in a meaningful manner, it is important that the appropriate materials be available. The researcher, therefore, felt that this issue was an important characteristic of schools in the South-west region of Saudi Arabia to explore. To provide this information, teachers were asked to give their opinion about the availability of the scientific materials in their schools by chosing one of three options: too much; not enough; not available. The results in Table 46 show that 24 teachers, 82.8%, admitted that insufficient scientific materials were available to them. Four teachers reported that too much scientific materials existed in their schools, while one teacher, 3.4% said that scientific materials were not available at all in the school where he taught.

Table 46

Frequencies and Percentages of Teachers' Opinions of the Availability of Science Materials in Intermediate Schools.

Availability	Frequency	Percentage
Too Much	4	13.8
Not Enough	24	82.8
Not Available	1	3.4
Total	29	100

6.3.2 DESCRIPTIVE STATISTICS OF STUDENT CHARACTERISTICS

In this part student characteristics are reported; these are student age and nationality.

6.3.2.1 STUDENT AGE

As already explained students were asked to report their age in a year standard. The results indicated that nearly 60% percent of students were aged 15 or 16 (33.9 and 24) respectively as shown in Table 47. Table 47 also indicated that four subjects were over twenty years old.

Table 47

Frequencies and Percentages of Students Age participated in this study.

Age	Frequencies	Percentages
14	87	7.7
15	383	33.9
16	271	24
17	233	20.6
18	96	8.5
19	40	3.5
20	15	1.3
21	4	0.4
Total	1129	99.9

6.3.2.2 STUDENT NATIONALITY

Among the demographic questions students asked was the nationality of the students. The results indicated that 151 (13.4%) subjects were non-Saudi while the remaining (86.6%) were Saudi subjects as shown in Table 48.

Table 48

Frequencies and Percentages for Students participated in this study.

Nationality	Frequencies	Percentages
Saudi	978	86.6
Non-Saudi	151	13.4
Total	1129	100

6.3.3 DESCRIPTIVE STATISTICS FOR CHARACTERISTICS OF HOME

This part provides descriptive statistics for father's education, mother's education, father's occupation, mother's occupation and family size.

6.3.3.1 FATHER'S EDUCATION

Based on the criteria explained in chapter 4 the following results were obtained from students who reported their fathers' educational level.

Table 49 shows that about one third of students' fathers read and write but are without a formal qualification (29.5%), another (20%) of students' fathers had primary education.

Table 49 also shows that about (13 %) of students' fathers had a degree or higher education.

Table 49

Frequencies and Percentages of Father's Educational Level.

Father's Education	Freq	%
1 He does not read nor write	65	5.8
2 He reads and writes but does not have formal qualifications	333	29.5
3 He has a primary Education	112	9.9
4 He has an intermediate Education	233	20.6
5 He has a diploma (nursing, teaching etc.,)	83	7.4
6 He has a secondary Education	78	6.9
7 He has a degree	119	10.5
8 Others	23	2.0
Total	1129	100

6.3.3.2 MOTHER'S EDUCATION

The results of mothers' education shown in Table 50 indicate that the majority of students' mothers who participated in the sample read and write but are without a formal qualification (817, 72.4%). The Table also indicated that a very few mothers had a degree or higher education (42, 3.7% and 37, 3.3%) respectively.

Table 50

Frequencies and percentages of Mother's Educational Level

Education Level	Freq	%
1 She does not read or write	20	1.8
2 She reads and writes without formal education	817	72.4
3 She has a primary Education	53	4.7
4 She has an intermediate Education	43	3.8
5 She has a diploma (nursing, teaching etc.,)	90	8.0
6 She has a secondary Education	26	2.3
7 She has a higher Education	42	3.7
8 Other	37	3.3
Total	1129	100

6.3.3.3 FATHER'S OCCUPATION

Chapter four has explained the classification of the occupation of students' fathers. A list of these occupations was distributed with the student instrument, students asked to pick up whatever occupation was appropriate to their fathers. The results in Table 51 indicate that a high percentages of student fathers were employed by the Saudi government (49.7%), this percentage was followed by (16.5%) who were businessmen, more details can be seen in Table 51.

Table 51

Frequencies and Percentages of Fathers' Occupation of Students who participated in the main Study (N=1129).

Father's Occupation	Freq.	%
1 Government employees	567	49.7
2 Businessman	186	16.5
3 Work in the private sector	25	2.2
4 Professional	142	12.6
5 Self-employed	40	3.5
6 Farmer	42	3.7
7 Retired	69	6.1
8 Other	64	5.7
Total	1129	100

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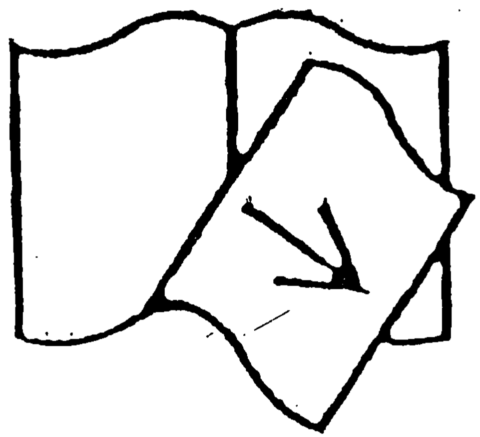

family size in western countries due to culture and religious reasons.

The answer to this question was put in two categories 2-4 Children or more than four Children.

The results in Table 53 show that the overwhelming majority of families in Southwest Saudi Arabia have more than four children (96.5%).

Table 53

Frequencies and Percentages of Students Responses to Family Size. (N=1129)

Family Size	Frequencies	Percentages
1 2-4	40	3.5
2 More than 4	1089	96.5
Total	1129	100

PART FOUR

HOW DO SAUDI ARABIAN INTERMEDIATE MALE STUDENTS PERCEIVE THEIR SCIENCE TEACHERS?

The characteristics associated with Teacher Pre-classroom Behaviour and Teacher Classroom Behaviour of integrated-science teachers as reflected by their students' responses to the ISSPQ items are contained in Tables 54 and 55.

6.4.1 TEACHER PRE-CLASSROOM BEHAVIOUR

As can be seen from Table 54, teachers' good scientific knowledge (item 1, 84%) and teachers' organised presentations of the main ideas of a lesson (item 2, 82%) were the characteristics which students agreed as occurring most frequently among the integrated-science teachers. Students gave moderate responses to other teachers' characteristics: items 4, 6 and 7 (conducting the laboratory activities confidently 75%, carrying out the laboratory activities successfully 75% and giving satisfactory explanations to students' questions: 75%, respectively. Other items 3 and 5 (planning laboratory activities 67 % and collecting laboratory materials for laboratory activities 54%) were ranked by the students as much less often displayed by the teachers.

Table 54

Frequencies and Percentages of Students' Perceptions of their Science Teachers on the Characteristics Associated with Pre-Classroom Behaviour (N=1129).

Item	AGREE		NOT SURE		DISAGREE	
	Fr.	%	Fr.	%	Fr.	%
1 This science teacher knows the subject very well.	948	84	135	12	46	4
2 This science teacher presents the main ideas in an organised and integrated way.	922	82	101	9	106	9
3 This science teacher makes adequate plans for the laboratory activities.	755	67	172	15	202	18
4 This science teacher conducts the laboratory activities confidently.	848	75	164	15	117	10
5 This science teacher collects all the necessary materials for laboratory activities.	612	54	244	22	273	24
6 This science teacher carries out laboratory activities successfully.	851	75	163	14	115	10
7 This science teacher gives satisfactory explanations to students' questions.	850	75	108	10	171	15

6.4.2 TEACHER CLASSROOM BEHAVIOUR

As explained in Chapter Five that some items from the scale of Teacher Classroom Behaviour were deleted and modified which left this scale with 21 items.

For the Teacher Classroom Behaviour, Table 55 indicates that Saudi students perceived their integrated science teachers as very disposed to the use of questioning, interacting orally with students (items 1; 82%, 3; 80%, 14; 83%, 19; 79% and 20; 73%). However, they perceived their science teachers as less disposed towards open questioning (item 16, 49%) and using non-verbal material (item 4, 42%).

Students also gave relatively high responses to teachers' communication and use of reinforcement skills (items 7, 76% and 13, 76%), while they gave less favourable responses to items 6, 66%; and 8, 63%.

Teachers were perceived by their students as communicating well in their laboratory activities behaviour (item 5, 80%) as shown in Table 55.

Regarding teacher's attitude towards teaching, these characteristics had relatively high ratings from students (item 21, 78%).

Communication and classroom management, control and discipline skills (items 2, and 10) had mixed responses from students, with high responses being given to item 2, 84%, whereas item 10, 63%; received a moderate responses.

Students gave moderate ratings to science teachers' behaviour in managing the classroom and using reinforcement (items 15; 67% and 17; 74%).

While students gave favourable ratings to certain teaching behaviours, they nevertheless gave slightly less favourable responses to other behaviours such as reinforcement (item 9, 29%), personality and communication (item 12, 13%) laboratory behaviour (item 11; 22%, and 18; 49%) as shown in Table 55.

Table 55

Frequencies and Percentages of Students' Perceptions of Teachers' Classroom Behaviour of ISSPQ (N=1129).

Item	AGREED		NOT SURE		DISAGREED	
	Fr.	%	Fr.	%	Fr.	%
1 This science teacher uses simple and clear words when explaining a lesson.	921	82	70	6	138	12
2 This science teacher asks questions during a lesson to hold our attention.	944	84	71	6	114	10
3 This science teacher gives us a chance or a clue when answering questions.	901	80	71	6	157	14
4 This science teacher uses enough audio-visual and living and non-living aids to make a lesson clear.	479	42	187	17	463	41
5 This science teacher asks questions during practical work to make sure we understand what he is doing.	898	80	84	7	147	13
6 This science teacher asks questions at the end of each lesson.	739	66	62	5	328	29
7 This science teacher summarises and goes over the main ideas of a lesson before the end.	858	76	67	6	204	18

(Continued Table 55)

Item	AGREED		NOT SURE		DISAGREED	
	Fr.	%	Fr.	%	Fr.	%
8 This science teacher does not go over examination papers after they have been marked and does not discuss the results with us.	714	63	124	11	291	26
9 This science teacher does not use homework marks to find out if we need help in understanding our work.	617	55	181	16	331	29
10 This science teacher asks questions around the classroom so that we cannot predict who is going to be asked.	710	63	165	15	254	22
11 This science teacher gives us a chance to do experiment by ourselves.	244	22	109	10	776	69
12 This science teacher does not like us asking him questions.	869	77	111	10	149	13
13 This science teacher moves from one subject to another before making sure that we all have understood the previous one.	856	76	84	7	189	17
14 This science teacher presents the main ideas in a lesson in a way that is easy to follow.	937	83	60	5	132	12

(Continued Table 55)

Item	AGREED		NOT SURE		DISAGREED	
	Fr.	%	Fr.	%	Fr.	%
15 This science teacher finds different ways of teaching science to interest us in the subject.	760	67	130	12	239	21
16 This science teacher asks more questions than are included in our textbooks.	551	49	109	10	469	41
17 This science teacher finishes topics and experiments in good time before the end of lessons.	835	74	80	7	214	19
18 This science teacher spends too much time giving us facts, information instead of practical experimental work.	557	49	114	10	458	41
19 This science teacher does not ignore our ideas but makes use of them in discussions.	890	79	92	8	147	13
20 This science teacher invites and values various of points of view from us.	819	73	142	13	168	15
21 This science teacher is very keen on what he/she teaches.	885	78	188	17	56	5

PART FIVE

THE CORRELATION ANALYSIS STUDENT, TEACHER, AND HOME VARIABLES IN RELATION TO STUDENT ATTITUDES AND ACHIEVEMENT IN SCIENCE.

Before undertaking the correlation analysis it is worthwhile to explore the method of scoring each variable. For teacher variables it was decided to order teachers' qualification according to the highest degree (i.e., giving teachers without degree a smaller value then to the highest for teacher with a degree in education in two subjects areas). For Teaching Experience the more the teacher is experienced the more the number eg., one for teacher with less than 5 years experience. It was not possible to get the average of the Teaching Experience for the teachers participated in the study and treat them as above and below the average, this is due to the structure of the question in which teachers had to chose the range of their Teaching Experience. The same limitation applies to Teaching Load and also to Classroom Size.

With regard to the rating instruments and the Student Achievement Test, the means of the scores of the students of each teacher for each scale were computed for the whole teacher sample of 29. It is correct to use the class as the unit of analysis in this case because all the students in the class give information about the same teacher.

For the Student Science Achievement the results in Table 56 indicated that the maximum value was 32 and the minimum value was 5 with the mean of 23.66 and standard deviation of 4.66 for all 29 teachers. For the Attitude Towards Science the maximum value was 70 and the minimum value was 21 with the mean of 53.12 and standard deviation of 10.13. The School Achievement Motivation the maximum value was 45 and the minimum value was 9 with the mean of 34.43 and the standard deviation of 5.32. For the Teacher Pre-classroom Behaviour the maximum value was 21 and the minimum value was 7 with the mean of 18.21 and standard deviation of 2.79. Similarly for Teacher Classroom Behaviour where the maximum value was 63 and the minimum value 21 with the mean of 51.35 and standard deviation of 5.89 (more statistical details can be found in Appendix B).

With regard to home environment (Mother's and Father's education and occupations), the education of parents was rated from the lowest to the highest levels.

The occupation of parents were rated according to the priority as shown in chapter four.

To find out to what extent teacher, student and home variables affect student outcomes, correlation analyses were undertaken. The means of each variable for the 29 teachers were correlated with the factors of age, experience etc.

Table 56

Descriptive Statistics for Teacher and Student Rating Variables.

Variable	Mean	SD	Minimum-Maximum of Observed Values
SSA	23.66	4.66	5-32
ATS	53.12	10.13	21-70
SAM	34.43	5.32	9-45
TPCB	18.21	2.79	7-21
TCB	51.35	5.89	21-63

SSA Student Science Achievement
ATS Attitude Towards Science
SAM School Achievement Motivation
TPCB Teacher Pre-classroom Behaviour
Teacher Classroom Behaviour.

6.5.1 TEACHER VARIABLES AND STUDENT SCIENCE ACHIEVEMENT.

In this part all teacher variables were correlated using Pearson Product Moment Correlation (r) in which correlations were undertaken for science achievement outcome with each of teacher age, race, teaching experience, teacher qualification, teacher pre-classroom behaviour, teacher classroom behaviour, classroom size and teaching load.

In this section the following question will be examined:

Are there any Significant Correlations between Student Achievement in Science and each of the following Teacher Characteristics: Age, Teaching Experience, Qualification and Student Perception Variables: Teacher's Pre-Classroom Behaviour and Teacher Classroom Behaviour?

Table 57 shows that only Teacher Qualification correlated significantly with Student Science Achievement (r=-0.42). Therefore, Teacher Qualification was more strongly related to student science achievement than the variables of teacher classroom behaviour, teacher pre-classroom behaviour, or school related variables of classroom size and teaching load. The non-significant results can be found in Appendix B.

Table 57

Correlations of Teacher Characteristics of Qualification, (N=29).

Variable	S. Science Achievement
Teacher Qualification	-0.42*

* P< 0.05

The other teacher variables had no significant correlation with Student Science Achievement (See Table 63).

6.5.2 TEACHER VARIABLES AND STUDENT ATTITUDE TOWARDS SCIENCE.

All the teacher variables (see list above) were tested for Pearson Product Moment Correlation (r) with student attitudes to science. From Table 58, the results show that there were positive significant correlations of student's attitudes with teacher pre-classroom behaviour (r=0.36) and teacher classroom behaviour (r=0.66). A negative significant correlation was found between class size and student attitude towards science (r=-0.44).

Finally, it is interesting to find that the qualification of the teacher, teacher age, teacher race and teaching load were not related to student attitudes towards science.

Table 58

Correlations Between Teachers' Characteristics (Teacher Pre-Classroom Behaviour Classroom Behaviour, and Class-room Size) with Student Attitude Towards Science (N=29).

Variables	Attitude Towards Science
T. Pre-classroom Behaviour	0.37*
T. Classroom Behaviour	0.66***
Classroom Size	-0.44**

* P< 0.05 ** P<0.01 *** P<0.001

The other teacher variables had no significant correlation with Student Attitude Towards Science (See Table 63).

6.5.3 CORRELATIONS OF STUDENT VARIABLES WITH STUDENT OUTCOMES

This section aims at finding out possible correlations between such student variables of race and SAM (School Achievement Motivation) with attitude to and achievement in science. The race variable was classified into two categories: Saudi and Non-Saudi students. A label 1 was given to Saudi students, while the label of 2 was given to Non-Saudi students.

In this section the following questions are answered:

Are there any Significant correlations between Student, Age, Race, School Achievement Motivation, and Attitude Towards Science and Student Achievement in Science?

The results indicate that no significant correlations were found between any of student variables and Attitudes towards science and Student Science Achievement (as shown in appendix B)

A further question was explored, namely,

Are there any significant correlations between Student, Age, Race, School Achievement Motivation and Student Attitude Towards Science?

The student characteristics of age, race and School Achievement Motivation are explored in relation to student attitude towards science. When the correlation carried out between each of these variables and Student Attitude Towards science the results in Table 59 show that there was a positive significant correlation between School Achievement Motivation and Student Attitude Towards science (r=0.62).

Table 59

Correlations of Student Variables of School Achievement Motivation with Student Attitude Towards Science (N=29).

Independent Variable	Dependent Variable Attitude Towards Science
SCHOOL ACHIEVEMENT M.	0.62*

* P< 0.001

The other student variables had no significant correlation with student attitude towards science (See Table 63).

6.5.4 CORRELATIONS OF HOME VARIABLES WITH STUDENT OUTCOMES

All home variables were tested for correlation with both Student Science Achievement and Student Attitude Towards Science. Results indicated that there was no significant correlation between home variables of Mother's Education, Father's education, Mother's Occupation, Father's Occupation and Family Size and Student Science Achievement and Student Attitude Towards Science.

6.5.5 CORRELATIONS BETWEEN TEACHER VARIABLES (STUDENT PERCEPTION OF THEIR TEACHERS BEHAVIOUR) AND SCHOOL ACHIEVEMENT MOTIVATION VARIABLE.

Table 60 shows that Teachers' Pre-classroom Behaviour and Teacher Classroom Behaviour were significantly related to the student variable of School Achievement Motivation (r=0.50, and r=0.39 respectively).

Table 60

Correlations between Student Variables (School Achievement Motivation) and Teacher Behavioural Variables Teacher Pre-classroom Behaviour and Teacher Classroom Behaviour (N=29).

Teacher Variables	Student Variables
	School Achievement Motivation
TPCB	0.50*
TCB	0.39**

*P<0.01 ** P<0.05

TPCB Teacher Pre-Classroom Behaviour
TCB Teacher Classroom Behaviour

6.5.6 CORRELATIONS OF TIME SPENT DOING HOMEWORK WITH TEACHER STUDENT AND HOME VARIABLES, STUDENTS' ATTITUDES TOWARDS SCIENCE AND SCIENCE ACHIEVEMENT.

As indicated in previous section of the discussion on student variables, students were asked to report the amount of time, in hours, they spent doing their daily homework. The extent to which the time students spend on homework correlates with other student variables, such as home and outcome variables is explored in this section.

Thus, information on the following question is sought:

Are there any Significant correlations between Time Spent on Homework and the Variables related to Teacher, Student and Home and Student Outcomes?

In Table 61, data are presented based on the self-report of third-year intermediate male students of the amount of time they normally spend on homework. It can be seen that there is considerable variation in homework time between the students. 24.5 per cent of these students indicate that they spend one hour or less, on average, while nearly the same percentage (24.2%) reveal that they spend as much as three hours on homework every day. Nearly one third (32.6 per cent.) of the sample report spending 2 hours in doing their daily homework. Nearly 13 per cent of the sample admit that they spend 4 hours in or after school time doing their allocated homework. Only a few students report that they spend 5 (3.7 per cent.) or 6 (2.5 per cent.) hours completing their homework every day.

Table 61

Frequency and Percentages of Students Reporting Different Times Spent doing Homework (In Hours).

No. of hours Spent on Homework.	Frequency	Percentages
1 Hour	277	24.5
2 Hours	368	32.6
3 Hours	273	24.2
4 Hours	141	12.5
5 Hours	42	3.7
6 Hours	28	2.5
Total	1129	100

When the mean of time spent on homework for each teacher was tested for correlation with teacher, student home and outcomes variables the results in Table 62, show that no significant correlations between time spent on homework and Teacher Pre-classroom Behaviour, and Teacher Classroom Behaviour, and Student science achievement.

However Time Spent on Homework correlated significantly with only one home variable and that is Mother's educational level (r=0.39).

The results also indicated that there were significant positive correlations between Time Spent on Homework and student attitudes towards science (r=0.45).

The variable "time spent on homework" appears to be more associated with "student" and "home" variables rather than with "teacher" variables.

Table 62

Correlations between Time Spent on Homework and Teacher, Student Home, and Outcomes Variables.

Variable	Time Spent on Homework
Mother's Education	0.39*
Attitude Towards Science	0.45**

* P<0.05 ** P<0.01

6.5.7 SUMMARY

This part had identified the direction of significant correlation between Teacher, Student and Home variables with student attitude to and achievement in science. The significant correlation between such variables and schooling outcomes are reported in Tables 56-63. A summary of all correlations is shown in Table 63.

Table 63

Summary of the all Correlations of Teacher, Student and Home Variables with Outcomes.

Variable	S. Achievement	S. Attitudes
Teaching Qu.	-0.42**	0.24
Teaching Ex.	0.14	0.22
Teacher Age	-0.06	0.05
TPCB	0.17	0.37* SAM (0.50**)
TCB	0.07	0.66*** SAM (0.39*)
S. Age	-0.31	0.09
SAM	0.16	0.62***
M. Education	-0.08	0.07
F. Education	0.05	-0.12
M. Occupat.	-0.05	0.01
F. Occupat.	0.08	-0.08
F. Size	-0.10	0.08
T. Load	-0.20	0.12
TSH	0.03	0.45** M.Edu. (0.39*)
CS	0.07	-0.44**
SATS	-0.28	

TSH Time Spent on Homework CS Classroom Size

SATS Student Attitude Towards Science

* P< 0.05 ** P< 0.01 *** P<0.001

The previous part has only identified the magnitude of the separate correlations and up to this stage it is imposible to predict the total contribution of Teacher, Student and Home variables to Student Attitude to and Achievement in Science and this is the title of the next part.

PART SIX

THE CONTRIBUTIONS OF TEACHER, STUDENT AND HOME VARIABLES TO BOTH STUDENT ATTITUDE TO AND ACHIEVEMENT IN SCIENCE.

This section reports the results of the regression analyses which explored the contributions of each set of variables to both students' attitude to science and their achievement in science.

Jae-on-Kim and Frank (1975) defined multiple regression as a general statistical technique through which one can analyse the relationship between a dependent or criterion variable and a set of independent or predictor variables. They go on to suggest that such a procedure can be viewed either as a descriptive tool by which the linear dependence of one variable on others is summarised or as an inferential tool by which the relationships in the population are evaluated from the examination of sample data.

In this study multiple regression analysis was used to evaluate the relationships between all the variables derived from teachers, students and homes with student outcome variables. The resulting correlation matrix was used to investigate the dependence of both the students' science achievement and their attitude towards science on all the independent variables associated with only teacher and student where significant correlations were found. As indicated in part four, no home variable was significantly correlated with student attitude to and achievement in science. Therefore, the researcher undertook sets of regression analyses as appropriate with the student achievement and attitudes towards science as the dependent variables.

In these analyses the stepwise method was used. This method was identified by Youngman (1978) as the better predictor method in which more predictor variables than are considered relevant are included so that only the significant predictors are identified, much as principal components analysis extracts factors of decreasing importance. Stepwise regression picks the most important independent variables contributing to the variance of a dependent variable. In all, three regression analyses were undertaken, namely,

1. Stepwise regression solution between ***Teacher Variables*** and student attitudes to and achievement in science.

2. Stepwise regression solution between ***Student Variables*** and student attitude to and achievement in science.

3. Stepwise regression of the **Time** ***Spent on Homework*** with teacher student and home variables.

6.6 RESULTS OF REGRESSION ANALYSIS

When regression analysis was undertaken the same results obtained in the correlation were revealed again. This is because in most instances only one variables was regressed with the dependent variable.

6.6.1 STEPWISE REGRESSION ANALYSIS TO ASSESS THE CONTRIBUTION OF TEACHER VARIABLES TO STUDENT ACHIEVEMENT.

To assess the influence of Teacher Variables on Students' Science Achievement, Teacher Qualification, Teaching Experience, Teaching Load, Teacher Pre-classroom Behaviour and Teacher Classroom Behaviour were included in a stepwise regression analysis with science achievement as the dependent variable. The results indicated that Teacher Qualification accounted for overall 18% of the variance in Student Science Achievement as shown in Table 64. No other variable was included in the regression at the criterion level of p=0.05.

Table 64

Multiple Regression-Stepwise Solution for Teacher Qualification Variable with Student Science Achievement as Dependent Variable.

Variable	Multiple R	R^2 Square
T.Q	0.42	0.18
Total of Variance		18%

6.6.2 STEPWISE REGRESSION ANALYSIS TO ASSESS THE CONTRIBUTION OF TEACHER VARIABLES TO STUDENT ATTITUDE TOWARDS SCIENCE.

In this analysis teacher variables of Teacher Qualification, Teaching Experience, Teaching Load, Teacher Pre-classroom Behaviour and Teacher Classroom Behaviour were regressed with Student Attitude Towards Science as the dependent variable. The results indicated that Teacher Classroom Behaviour accounted for a large percentage 43% of the variance in Student Attitude Towards Science as shown in Table 65. No other variable was included in the regression at the criterion level of p=0.05.

Table 65

Multiple Regression-Stepwise Solution for Teacher Variable with Student Attitude Towards Science as Dependent Variable.

Variable	Multiple R	R^2 Square
TCB	0.66	0.43
Total of Variance		43%

6.6.3 STEPWISE REGRESSION ANALYSIS TO ASSESS THE CONTRIBUTION OF STUDENT VARIABLES TO STUDENT ATTITUDE TOWARDS SCIENCE.

When stepwise regression analysis was undertaken to assess the contribution of student variables of Age, Race, and School Achievement Motivation to Student Attitude Towards Science, the analysis indicated that School Achievement Motivation accounted for 39% of the variance in Student Attitude Towards Science as shown in Table 66. Again, no other variable was included in the regression at the criterion level of p=0.05.

Table 66

Multiple Regression-Stepwise Solution for Student Variables of Age, Race and School Achievement Motivation with Student Attitude Towards Science as Dependent Variable.

Variable	Multiple R	R^2 Square
SAM	0.62	0.389
Total of Variance		39%

6.6.4 STEPWISE REGRESSION ANALYSIS TO ASSESS THE CONTRIBUTION OF TEACHER CLASSROOM BEHAVIOUR VARIABLES TO SCHOOL ACHIEVEMENT MOTIVATION.

Stepwise regression analysis was used to assess the contribution of teacher behaviour variables of Teacher Pre-classroom Behaviour, Teacher Classroom Behaviour to Student School Achievement Motivation. The results in Table 67 show that Teacher Pre-classroom Behaviour accounted for 25% of the variance in Student School Achievement Motivation and that no other variable was included in the regression at the criterion level of p=0.05.

Table 67

Multiple Regression-Stepwise Solution for Teacher Classroom Behaviour Variables with School Achievement Motivation.

Variable	Multiple R	R^2 Square
TPCB	0.498	0.25
Total of Variance		25%

6.6.5 STEPWISE REGRESSION ANALYSIS TO ASSESS THE CONTRIBUTION OF TEACHER, STUDENT AND HOME VARIABLES TO TIME SPENT ON HOMEWORK.

Stepwise regression analysis was undertaken to assess the contribution of all Teacher, Student and Home Variables to Time Spent on Homework. The results in Table 68 show that 3 variables were included in the regression equation, Student Attitude Towards Science, Mother's Educational Level and Teacher Classroom Behaviour accounted for a total of 49% of variance in Time Spent on Homework. No other variable was included in the regression at the criterion level of p=0.05.

Table 68

Multiple Regression-Stepwise Solution for Teacher Student and Home Variables with Time Spent on Homework.

Variable	Multiple R	R^2 Square
Attitude T. Science	0.45	0.206
Mother's Education	0.62	0.386
TCB	0.70	0.49
Total of Variance		49%

6.6.6 SUMMARY

This part has identified the contribution of Teacher, Student and Home variables to Student Attitude to and Achievement in Science. From teacher variables only teacher qualification accounted for low proportion of variance in Student Science Achievement. None of Student or Home variables contributed to prediction of Student Science Achievement.

For Attitude Towards Science, Teacher Classroom Behaviour contributed for moderate value in Student Attitude Towards science. Student School Achievement Motivation contributed for another moderate value of variance in Student Attitude Towards Science. None of the home variables contributed to Student Attitude Towards Science.

Teacher Classroom Behaviour contributed to the variance in Student School Achievement Motivation.

Finally, some Teacher, Student and Home variables were associated with Time Spent on Homework as shown in Table 69.

Table 69

Summary of the Contribution of Teacher, Student and Home Variables to Student Attitudes to and Achievement in Science and Schooling related Variables in Percentages .

Independent Variable	S. Achievement	S. Attitudes
T.Q	18%	-
TCB	-	43%
SAM	-	39%
TPCB	SAM (25%)	
TSH	M.ED, SATS and TCB (49%)	

T.Q Teaching Qualification
SATS Student Attitude Towards Science
TCB Teacher Classroom Behaviour
SAM School Achievement Motivation
TPCB Teache Pre-classroom Behaviour
TSH Time Spent on Homework

CHAPTER SEVEN

SUMMARY, DISCUSSION, LIMITATIONS AND RECOMMENDATIONS

7.0 INTRODUCTION

This Chapter is divided into three parts, discussing in turn, Summary of the main study for the main findings of this study; discussing this study with previous findings with special reference to Chapter Three and Finally reporting the limitations and recommendations of this study.

7.1 SUMMARY

Teacher, student and home variables are likely to affect student learning and play an important role in student academic achievement. This study has been an attempt to explore some of the relationships between teacher, student and home variables and both student science achievement and attitudes. Furthermore, some factors related to school variables such as teaching load and classroom size were also investigated.

The study considered some variables of teacher, student and home in relation to attitudes to and achievement in science of boys in the third year of the intermediate school in Southwest Saudi Arabia. Also, probably for the first time in Saudi Arabia, students' perceptions of their science teachers behaviours were fully measured. This allowed both presage and process-type variables to be assessed. Teacher variables included teacher's qualification, teaching experience, and teacher's race (the "presage" variables), pre-classroom behaviour and classroom behaviour, (the "process" variables).

Personal background data were obtained from teachers by means of teachers' reports, while the data relating to the teacher behaviour, classroom personality and classroom attitude were collected by means of student perceptions of their science teacher using the ISSPQ , developed by Jegede (1989).

The student background data were age and race obtained from students' reports. Other instruments were used to collect data from students, who expressed their answers to each item on a five-point Likert-type scale. These scales were attitudes towards school, science self-concept and self-achievement motivation. Student scientific knowledge was tested using test of multiple-choice. Students were also asked to report the time they spent each school day on homework.

Home data were collected by means of student reports of their parents' education and occupation.

The results described in chapter 6 showed that both Saudi and non-Saudi Arabian students perceived their science teacher as knowledgeable in using laboratory activities as a way of teaching science (irrespective of who performed these activities), presenting the main ideas in the lesson in an easy way to follow, using less audio-visual aids to make science lessons clear, asking questions, summarising and going through the main points of a lesson. They also, perceived their science teachers as respecting students' views.

Taking the sample as a whole, a negative significant correlation was found between Teacher Academic Qualification and Student Science Achievement.

Two teacher variables were found to be significantly and positively correlated with Student Attitudes Towards Science. These were Teacher Pre-classroom Behaviour and Teacher Classroom Behaviour.

One student variable School Achievement Motivation was found to be significantly correlated with Student Attitude Towards Science.

Analyses were made to find out the relationships between student perceptions of their science teachers (Teacher Pre-classroom Behaviour, Teacher Classroom Behaviour) with the student variable of School Achievement Motivation. The two teacher variables were found to be significantly correlated with the student variable of School Achievement Motivation.

A positive significant correlation was found between School Achievement Motivation and Time Spent on Homework.

Of home variables, only Mother's Educational level was found to be correlated significantly and positively with Time Spent on Homework.

Surprisingly, no significant correlation was found between Time Spent on Homework and Student Science Achievement.

Finally, a significant positive correlation was found between Student Attitude Towards Science and Time Spent on Homework.

As indicated in Chapter Six that some variables were not-correlating significantly with Student Science Achievement, but these variables were correlated with the science achievement and sometime they confirm some findings as shown in Table 70.

Table 70

Comparison between this study findings and Previously Reported findings in Chapter Three.

Variables	Author	Date	Subject	Value	This Research
Teaching Experi-ence	Fagan Ponder. Fraser et al.	1981 1987	General Synthesis	0.17 0.10	0.14
Student Age	Key Dreinth et, al.	1987 1983	Science Science	-0.02 -0.09 -0.05 -0.03 -0.23 -0.16	-0.31
SAM	Hattie	1982	General	0.21	0.16 = 0.20
Students' Percep-tion.	Tairab	1992	Biology	0.17- 0.36 0.36	0.17
Attitude Towards Science	Al-Sha rgi	1987	Science	-ve	-0.28

7.2 DISCUSSION

This study attempted to fulfil the following objectives;

1. to identify the Saudi Arabian Intermediate Male Students' Perceptions of their Science Teacher;

2. to identify any significant correlations between achievement and attitude towards science and each of the following Teacher's Variables: Teacher Teaching experience, Teaching qualification, Teacher pre-Classroom Behaviour, Teacher Classroom Behaviour, Teaching Load and Classroom Size;

3. to identify any significant correlations between Student Variables and both Student Science Achievement and Attitude;

4. to identify any significant correlations between both Student Achievement and Attitude outcomes with Family variables (Socio-economic Status and Family Size);

5. to identify any significant intercorrelations of Teacher Pre-classroom and Teacher Classroom Behaviour, with School Achievement Motivation;

6. to identify any significant correlations between Time Spent on Homework and Student, Teacher and Home Variables and Student Attitude to and Achievement in Science;

7. to identify the contribution of Teacher, Student and Home to Student Attitude to and Achievement in Science;

8. to identify the contribution of Teacher, Student and Home to Time Spent on Homework;

9. to identify the contribution of Teacher Behavioural Variables to Student School Achievement Motivation;

In discussing the results, the contributions made by different sets of variables to attitudes and achievement in science will be examined in addition to that made by all the variables combined.

The following section discusses the results obtained for the research objectives in regard to the correlations of the chosen variables with student attitudes to and achievement in science. These results will be discussed in relation to the findings of previous research studies as reported in chapter three.

7.2.1 SAUDI ARABIAN INTERMEDIATE MALE STUDENTS' PERCEPTIONS OF THEIR SCIENCE TEACHER.

7.2.1.1 TEACHER PRE-CLASSROOM BEHAVIOUR

As shown in part four of Chapter Six the majority of the students had favourable perceptions of their Teachers' Pre-classroom Behaviour characteristics. Table 54 shows that teacher scientific knowledge (item 1) and teacher presentation of the main ideas of a lesson in an organised and integrated way (item 2) were ranked the highest as being the characteristics which students agreed as occurring most frequently among the integrated-science teachers. These are important characteristics for teachers of any subject. It was highlighted by Waterhouse (1983) that a good teacher is one with good subject knowledge and communication skills. Eddy (1988) found that science teachers were perceived by their students as knowing much about science. These characteristics were similar to the characteristics of good teachers identified by Jegede (1989). Students, however, gave moderate responses to items 4 and 6 (conducting the laboratory activities confidently, and carrying out the laboratory activities successfully. These are important skills for science teachers, which were also identified by Jegede (1989).

On the other hand, Items 3 and 5 (planning laboratory activities, and collecting laboratory materials for laboratory activities) were ranked by the students as less often displayed by the teachers. This was in a syllabus which has little emphasis on learning by doing. The findings of this study support the results obtained by Reffaa (1991), who found that only one fifth of each term's science lessons in Saudi Arabian Intermediate Schools are used for laboratory activities, and these take the form of teacher demonstration.

7.2.2.2 TEACHER CLASSROOM BEHAVIOUR

For the Teacher Classroom Behaviour, Saudi students perceived their integrated science teachers as very disposed to the use of questioning, interacting and communicating with students, managing and controlling classroom activities, discipline and using reinforcement. These important characteristics were previously identified by Al-methen and Wilkinson (1986), Jegede (1989) and Tairab and Wilkinson (1991).

Table 55 indicated that students perceived their teachers in slightly less favourable responses to other behaviours such as using non-verbal material and laboratory activities, personality and communication (items 4, 11, 12 and 18). These characteristics should be shown by all teachers, but it seems likely that the science teachers in Saudi schools need to allow their students to do more experiments themselves. These results agree with those of Jegede (1989) from Nigeria and Ebenezer & Zoller (1993) who found that almost 74% of the students never did experiments individually. There is further evidence that in Saudi classrooms, students do little practical work.

7.2.2 CORRELATIONS BETWEEN ACHIEVEMENT AND ATTITUDE TOWARDS SCIENCE AND EACH OF THE FOLLOWING TEACHER VARIABLES: TEACHING QUALIFICATION, TEACHER PRE-CLASSROOM BEHAVIOUR, TEACHER CLASSROOM BEHAVIOUR AND CLASSROOM SIZE.

7.2.2.1 TEACHING QUALIFICATION

Taking the sample as a whole, a negative correlation (r=-0.42) was found between teacher academic qualification and students' science achievement, as shown in Table 57. This means that the higher the teacher qualification, the less the student science achievement.

The B.Sc. and Education teachers, irrespective of their specialities, generally produced lower science achievement results. This finding is inconsistent with the results of Ponder (1977) who found that achievement is higher among those students with more highly qualified teachers and with the results of Fagan and Ponder (1981) who also found that there was a positive correlation between student achievement and the qualification of teacher.

Although the association was not very strong (r=-0.42), this is very surprising to find, particularly in science. This result should not be taken for granted. However, this result could be attributed to some factors already explained in Chapter One, regarding the selection of Teaching Diploma Teachers, where acceptance is highly competitive and many teachers are rejected because they do not meet the standard. Another reason could be that teachers who possessed a Teaching Diploma had experience of teaching at primary level, which might have helped them to perform better at intermediate level.

7.2.2.2 CORRELATIONS BETWEEN TEACHER VARIABLES AND STUDENT ATTITUDES TOWARDS SCIENCE

In the results given in Table 58 of Chapter Six, three teacher variables were found to be correlated significantly with attitudes towards science. These were Teacher Pre-classroom Behaviour, Teacher Classroom

Behaviour and Teacher's Teaching Experience. It is also noted that students' perceptions of their science teacher were better correlated with attitude towards science than with Student Science Achievement. It is very interesting to note that the strongest correlation occurred with Teacher Classroom Behaviour, which may indicate that teacher's laboratory activities, and teachers' plans and presentation of their laboratory activities were associated with science attitudes more than other teacher variables. These results with those in a following section show that teacher classroom variables correlate more strongly with affective variables than with cognitive variables.

The finding that Students' Attitude Towards Science is related to student perceptions of their science teacher is in agreement with findings reported by McMillan and May (1979), who found that teacher personality and interrelationships with students are crucial variables in attitude formation, and the results of Pogge (1986) who found a strong correlation between students' perceptions of their science teachers and Students' Attitudes Towards Science.

Classroom size was found to be significantly negatively correlated with Student Attitude Towards Science. This finding is not surprising, as it is consistent with the findings of Ward (1976) and Smith and Glass (1979).

7.2.3 CORRELATIONS BETWEEN STUDENT VARIABLES AND BOTH STUDENT SCIENCE ACHIEVEMENT AND ATTITUDE.

This section discusses the findings obtained from Chapter Six which correlated student variables of Age, Race, School Achievement Motivation with Student Attitude Towards Science.

7.2.3.1 CORRELATION BETWEEN STUDENT VARIABLES AND STUDENT SCIENCE ACHIEVEMENT.

As shown in Chapter Six, none of the student variables correlated significantly with Student Science Achievement, though some variables correlated positively/negatively with achievement, but these correlations were not significant.

7.2.3.2 CORRELATION BETWEEN STUDENT VARIABLES AND ATTITUDE TOWARDS SCIENCE

As the result in Table 60 indicated, only School Achievement Motivation (SAM) was found to be significantly correlated (0.62) with Student Attitude Towards Science. This finding indicates that the composite student personality variable correlated better with science attitude than with science achievement. This finding is not surprising as it was stated by Mitchell & Simpson (1982) that a correlation between one affective variable and another affective variable is always stronger than a correlation between an affective variable and a cognitive variable. The results of this study support this. This finding is also in harmony with the results of Mitchell & Simpson (1982), Simpson & Simpson (1990), Harty et al. (1986) and Hasan (1985), who all found that attitudes towards science correlate significantly with self-concept of academic ability.

7.2.4 CORRELATIONS BETWEEN BOTH STUDENT SCIENCE ACHIEVEMENT AND ATTITUDE TOWARDS SCIENCE AND FAMILY VARIABLES (SOCIO-ECONOMIC STATUS AND FAMILY SIZE).

As indicated in Chapter Six, none of the Home variables was found to be significantly correlated with both Student Attitude Towards Science and Student Science Achievement.

7.2.5 INTERCORRELATIONS OF TEACHER PRE-CLASSROOM AND TEACHER CLASSROOM BEHAVIOUR WITH SCHOOL ACHIEVEMENT MOTIVATION.

In Chapter Six an analysis was carried out to find out the correlations between students' perceptions of their science teachers (Teacher Pre-Classroom Behaviour, Teacher Classroom Behaviour) with student variables of School Achievement Motivation.

The results in part five showed significant correlation between Teacher Classroom Behaviour variables and the student variable of School Achievement Motivation.

It may, however, simply mean that those students, who are well motivated, have positive attitudes to school and possess good self-concepts, may perceive their teacher behaviour in the classroom favourably. However, such significant correlations do not provide any explanation of the cause of such relationships between variables.

7.2.6 CORRELATIONS BETWEEN TIME SPENT ON HOMEWORK WITH SCHOOL ACHIEVEMENT MOTIVATION FAMILY VARIABLES AND STUDENT ATTITUDE TO AND ACHIEVEMENT IN SCIENCE.

Chapter Six also reported the results of the correlations between time spent on homework and all the teacher, student and home variables.

The results in Table 63 indicated that of home variables, only Mother's educational level was found to be positively correlated with Time Spent on Homework. This is not a surprising result, because mothers traditionally are at home looking after the welfare of the children. Therefore, it is likely that they will be influential in creating a healthy environment for learning, and may offer verbal encouragement which influences in the time that pupils spend on homework. Mothers may be in a better position to do this than fathers, who spend most of their time looking after the family financially.

There is also the possibility that this result is an example of type 1 error. Because it is one isolated example of a correlation between home variables and student variables, and not part of a larger pattern this possibility has to be considered.

It is not surprising that students who spend considerable time doing their homework will also tend to be those who possess enjoyment, satisfaction and commitment to science. Though it would be difficult to make assumptions as to cause and effect, the two factors may be mutually interacting in a two-way relationship.

7.2.7 THE CONTRIBUTION OF TEACHER, STUDENT AND HOME IN STUDENT ATTITUDE TO AND ACHIEVEMENT IN SCIENCE.

As indicated in Chapter Six, regression analyses were conducted to find out the contributions of combinations of Teacher, Student and Home variables to the student outcomes of Attitude to and Achievement in Science.

7.2.7.1 THE CONTRIBUTIONS OF TEACHER VARIABLES TO STUDENT OUTCOMES.

The results of the contribution of teacher variables to student outcomes in Tables 64 and 65 indicated that only Teacher Qualification accounted for 18% of the variance in science achievement. This value provides some useful information to suggest that teacher classroom behaviour had no contribution to student achievement. This result suggests that possibly other teacher variables should be sought and investigated to explain the remaining large proportion of variance in student science achievement.

When the contribution of teacher variables to Student Attitude Towards Science was assessed, the results indicated that Teacher Classroom Behaviour accounted for 43% of the variance in Student Attitude Towards Science, and that no other variable was included in the regression at the criterion level of P=0.05. This suggests that Teacher Behavioural variables predict Student Attitude Towards Science better than teacher demographic variables. The finding that students' attitudes are influenced by their perceptions of their teachers is in agreement with Mcmillan and May (1979) and Hasan (1985). These authors affirm that Teachers' Classroom Behaviour and their relationships with students, as perceived by the latter, have crucial influences on students' attitudes towards science.

7.2.7.2 THE CONTRIBUTIONS OF STUDENT VARIABLES TO STUDENT OUTCOMES.

As found in Chapter Six Table 66, School Achievement Motivation was found to account for 39% of the variance in Attitude Towards Science. No other variable was included in the regression equation at the criterion level of P=0.05. This finding supports the notion that affective variables contribute more to affective variables than to cognitive variables. This result supports the theory of Fishbein et. al, (1975) which suggests that behaviour is primarily influenced by a combination of the individual's attitudes towards the behaviour; and is consistent with the findings of Hasan (1985) and Simpson & Oliver (1990). The result is higher than the finding of Hasan (1985) who found a value of 11% of the variance of the contribution of self-concept of academic ability and attitude towards science. However, this finding was less than the value reported by Simpson and Oliver (1990), who found that science self-concept, self-achievement motivation and other variables accounted for 55% of the variance in attitude towards science for the 9th grade.

This contribution gave strong support to the newly modified instrument SAM as already explained in Part Two of Chapter Six.

7.2.7.3 THE CONTRIBUTIONS OF STUDENT, TEACHER AND HOME VARIABLES TO TIME SPENT ON HOMEWORK.

When stepwise regression analysis was undertaken to determine the contribution of Teacher, Student and Home variables to Time Spent on Homework, the results in Table 68 indicated that only one variable of each of Teacher, Student and Home variables accounted for a significant percent of the variance in Time Spent on Homework. These findings highlighted the contribution of other variables than traditionally researched variables, such as achievement. These findings might be helpful to indicate the scope for future research.

7.3 POSSIBLE LIMITATIONS OF THE PRESENT RESEARCH AND RECOMMENDATIONS.

This study was undertaken to investigate the correlation between teacher student and home variables in relation to achievement and attitudes to science. This research was limited in the following ways:

1. *Limited scope of curriculum assessed.*

Only the physics curriculum, over a limited period of time consisting of part of the second term of the school's year was considered. The reasons for this were explained in Chapter Four. The Student Science Achievement Test was designed for a limited period and to serve the researcher's purposes. However, the reliability was not as high as expected to be, about 0.90, which could be one reason why significant correlations between the Student Science Achievement and some of Teacher, and all Student and Home variables, were not found. Therefore, testing students on part of the curriculum is not advised, though the division and the structure of the academic year and the curriculum encourage such partial testing. Alternatively, two testing programmes, one in the middle of the academic year (end of the first term) and another at the end of the academic year (end of the second term) using standardized achievement tests, could be combined to obtain one score and correlated with other variables.

2. *Use of perception scales to assess students' views of their science teachers:* These may be too insensitive in portraying real differences in teacher behaviours. Also, the nature of some of the items may be difficult for the students to assess, particularly as certain activities, for example, involving laboratory activities, are not very common in some intermediate schools. Although the items of the perception scales were selected for their homogeneity in the pilot study, it is conceivable that some students may not perceive their teachers, for instance, as totally "good" in their behaviours; there may be some equivocation in their overall perceptions (Culture Barriers). Thus, the use of total scores for the four perception scales may not be completely reliable in the correlation and regression analyses leading to the teacher "process" variables having low predictive power.

3. *Too homogeneous a sample:* the selected sample does not consist of students with a full range of abilities, as those selected for intermediate schools have to pass an examination at the end of their elementary schools. This selected sample may have led to lower correlations than in other reported studies between the chosen variables in this research.

4. *Restriction of sample selection:* only boys and male science teachers were involved in the sample, so the

results can only been applied to boys' schools and their teachers.

5. ***Small Teacher Sample***: in this study only 29 teachers were used, and the qualifications, specialities and experience are different for all groups. Therefore, this sample is insufficient to resolve sub-groups.

6. More use of School Achievement Motivation: this developed instrument seems to be useful in the context of the Arabic culture, and surprisingly it was more reliable as one scale than in their separate scales as used with main constructors. Therefore, more use of this instrument is recommended.

Further Recommendations: This study found some significant correlations between teacher, student and home variables, though a larger number of non-significant relationships was also found.

Testing students on the whole science curriculum should be attempted rather than using the division of each science syllabuses for each term.

Given the difficulties of using the student perceptions of teacher classroom behaviour, as already explained earlier, a study could be attempted using other methods of recording teacher behaviour, such as using classroom observation, teacher interviews or teacher daily diary. Similarly, for parent and student variables, parents and students could be interviewed as one method of collecting data.

From the findings of this study it seems that teacher characteristics rather than what teachers do in the classroom influences student achievement. It would be desirable for research to be conducted into what courses teachers had in their in-service or pre-service training and an attempt made to correlate these variables with student outcomes.

If such comparisons were to be attempted, a larger number of teachers would be necessary and equal sub-groups.

It would be useful if another study was undertaken using different data collection techniques than the one used in this study and different aims and data analyses used or even different methodology approach such as case study or ethnographic study.

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APPENDICES

Appendix A

Student and Home Environment Questionnaire

1. Student Variables

Dear Student

The following questions were designed to collect data from you about yourself and your family. Please ring the appropriate number or phrase. Remember that these questions will not be used for any other purpose except for this research.

1. Age of the student: 14 15 16 17 18 19+

2. Nationality of the student: Saudi Non-Saudi

3. Family size; 1-3 4 or more

4. Father's Education

   1. Does not read or write
   2. He reads and writes but does not have formal qualifications
   3. He has primary certificate
   4. Intermediate certificate
   5 Diploma (nursing, teaching etc).
   6. Secondary certificate
   7. Higher Education
   8. Other

5. Mother's Education

   1. She does not read or write
   2. She reads and writes without formal education
   3. She has primary education
   4. She has intermediate education
   5. She has secondary education
   6. She has a diploma (nursing, teaching etc.)
   7. She has higher education degree.
   8. Other.

5. Father's Occupation

   1. Government clerk

2. Works in the private sector (Company, banks etc.,)
3. Businessman
4. Vocational
5. Self employed
6. Farmer
7. Retired
8. Unemployed
9. Other

6. Mother's Occupation

1. Housewife
2. Nurse
3. Teacher

Teacher's and School Resources Questionnaire

Dear Teacher...

The following questions are designed to collect data from some intermediate school teachers. Please answer in any way you prefer. Remember that these data are to be used only for this research and not for any other purpose, and the answers you give will be treated confidentially.

1.0 The questions below are concerned with certain personal details.

As you can see, your name is not required. This is in keeping with the promise to maintain anonymity.

1. Name of the school in which you teach

2. Nationality; Saudi Non-Saudi

3. Age 25 and below 26-30
31-35 36-40

4. If you are a contracted teacher, please indicate how long you have been in the country.
1. Below 5 years 5-10 years 10-15 years

2. The next set of questions is designed to find out some information about your qualifications, experience and class size.

Please pick the appropriate part which fits in with your qualification.

2.1. Teacher's Qualification

1. Diploma in Science and Mathematics 2. B.Sc
3. B.Sc & Education 3. M.Sc
4.M.Sc. and Education
5 Others

2.2. Teaching Experience

Please indicate by putting against the appropriate number the length of time you have been teaching science.

1. Less than 3 years
2. 3-5 years
3. 5-10 years
4. 10-15 years
5. Other

2.3. Number of students in the classroom

Please select the appropriate number which indicates the average number of pupils whom you teach in your classroom of your classroom in which you teach from the following;

1. 16-20 students
2. 21-25 students
3. 26-30 students
4. 31-35 students
5. 36-40 students

2.4. Teaching Load.

1. Less than 15
2. 15-19
3. 20-24
4. More than 24

Science Achievement Test
ENGLISH VERSION

Dear Student

Please answer all questions. For your information, this test does not have anything to do with your final marks. The purpose is to collect data for my postgraduate research.

As you can see, there are four answers, A, B, C and D. Only one answer is correct. Please answer either by putting ✓ or ◯ beside the correct answer.

THE SCIENCE ACHIEVEMENT TEST ITEMS

1 The unit of work is (Energy & Movement)
1. The Gramme 2. The Celsius
*3. The Joule 4. The Fahrenheit.

---

2 Which of the following describes the thermal equation accurately? (Energy & Movement)
*1. The mass of the hot water X specific heat X change in temperature = The mass of cold water X specific heat X change in temperature.
2. The amount of lost energy = The amount of gained energy.
3. M1 x N1 x ΔT1 = M2 x N2 x ΔT2
4. M1 X specific heat x Δ T1 = M2 x specific heat x Δ T2.

---

3 The unit in which temperature is measured: (Energy & Movement)
*1. Degree centigrade 2. Joule 3. Calorie
4. Gramme

---

4 Which of the following is not regarded as a source of energy? (Energy & Movement)
1. Sun *2. Sand 3. Oil 4. Electricity

(Continued)

5 Work is: (Energy & Movement)
*1. Force x distance 2. mass x volume
3. mass x density 4. density x volume

---

6 The amount of work which is needed to lift a body weighing 70 N to a distance of 7m is: (Energy & Movement)
1. 49000 Joules (newton-meter) *2. 490 Joules
3. 49 Joules 4. 4900 Joules

---

7 What is the weight of a body which can be lifted to a height of 3m if work done is 150 joules? (Energy & Movement)
1. 150 newtons 2. 5 newtons
3. 500 newtons *4. 50 newtons

---

8 You employ work of 250 Joules to lift a box weighing 50 N. How high do you lift it? (Energy & Movement)
1. 50 m 2. 15 m *3. 5 m 4. 150 m

---

9 The potential energy which results from gravity is; (Energy & Movement).
*1. Weight x height 2. Mass x volume of the body
3. Density x height 4. Density x volume

---

10 When you lift a body to a certain height, which of the following does not happen? (Energy & Movement)
1. I consume energy 2. I consume work
3. I consume effort *4. I consume volume

---

11 Energy cannot be created or destroyed, but it can be changed from one form to another. This is the principle of: (Energy Change).
1. Fraction 2. Kinetic energy
3. Potential energy *4. Energy

---

12 The energy of an object at rest or at a particular height is called: (Energy Change).
1. Friction 2. Energy
*3. Potential energy 4. Work

(Continued)

13 Which one of the following equations represents the amount of heat energy in a body? (Energy Change).

1. Mass x density x specific heat
2. Mass x density x change in temperature

*3. Mass x specific heat x change in temperature

4. Mass x volume x temperature.

14 The specific heat capacity of a substance is: (Energy Change).

1. The amount of energy (in joules) which is needed to raise the temperature of 1 gram of water by one degree centigrade.
2. A mixture of two liquids of different temperatures to become one temperature.

*3. The amount of energy which is needed to raise the temperature of 1 gram of substance one degree centigrade

4. The amount of temperature which is needed to change a substance from gas to a liquid.

15 The specific latent energy of water is; (Energy Change).

1. The change of a substance from a liquid to gas.

*2. 540 Calories/gramme (In the students' textbook).

3. The change of substance from solid to gas without going through the liquid state.
4. The amount of energy which is needed to raise the temperature of 1 gramme of water one degree centigrade.

16 Evaporation is: (Energy Change).

*1. The change of a liquid to a vapour, at a temperature below, or at its boiling point.

2. The change of a substance from gas to liquid.
3. The amount of energy which is needed to raise the temperature of 1 gramme of water one degree centigrade
4. The amount of temperature which is needed to change a substance from gas to a liquid.

17 Condensation is: (Energy Change)

1. The movement of energy of the molecule of a body.

*2. The change of a vapour or gas to a liquid when cooled.

3. The change of a substance from solid to gas without going through the liquid state.
4. A mixture of two liquids at different temperatures to reach one temperature.

18 Which one of the following machines could not change electrical energy to kinetic energy? (Energy Transfer). 1. Fans *2. Microphone 3. Washing machine 4. Food mixer
19 An Iron for pressing clothes is an example of the change of energy from : (Energy Transfer). 1. Electrical to chemical 2. Heat to chemical 3. Electrical to kinetic *4. Electrical to heat.
20 Falling water driving a dynamo is an example of the change of potential energy to : (Energy Transfer) 1. Kinetic energy then to chemical energy 2. Heat energy then to chemical energy *3. Kinetic energy then to electrical energy 4. Kinetic energy then to heat energy
21 Satellites carry small instruments which work to transfer energy. They; (Energy Transfer). *1. Change light energy to electrical energy 2. Change chemical energy to electrical energy 3. Change kinetic energy to electrical energy 4. Change light energy to chemical energy.
22 The discharge of a car battery is an example of a change of energy from; (Energy Transfer). 1. Electrical energy to kinetic energy 2. Electrical energy to heat energy. 3. Electrical energy to chemical energy. *4. Chemical energy to electrical energy and then to kinetic energy.
23 Burning the fuel in the motor of a car is a result of changing (Energy Transfer). 1. Kinetic energy to chemical energy then to heat energy. 2. Chemical energy to heat energy. 3. Chemical energy to light energy then to heat energy. *4. Chemical energy to heat then to kinetic energy
24 The oxidation of food in the body produces; (Energy Transfer) 1. Electrical energy 2. Kinetic energy 3. Light energy *4. Heat energy

(Continued)

25 Nuclear energy is produced as a result of : (Energy Transfer). 1. Separation of electrons from the atoms *2. Nuclear fission of the atoms 3. Reaction of the atoms 4. Increase in the attraction between parts of the nuclei of the atom. (Option 2 is the correct answer accourding to student science textbook in Saudi Arabia).
26 Many countries in the world do not use nuclear energy because: (Energy Transfer). 1. It is difficult to produce nuclear energy. 2. It is difficult to build a nuclear station. *3. It is dangerous and costly to produce nuclear energy. 4. There is a shortage in the raw materials to produce nuclear energy.
27 The transfer of energy by waves has been used in many fields. Which one of the following does not use wave energy in order to work? (Energy Transfer). 1. Radio 2. Television *3. Air conditioner 4. radar
28 When an electric current runs through a lamp the energy is changed from: (Energy Transfer). 1. Chemical energy then to heat energy 2. Electrical energy then to kinetic energy. *3. Electrical energy to heat energy then to light energy. 4. Chemical energy then to heat energy
29 The internal and external combustion engine depends on the idea of stored energy. Which of the following does not have stored energy? (Technology). *1. Sand 2. Wood 3. Coal 4. Oil
30 The mouthpiece of the telephone contains small granules of (Technology). *1. Carbon 2. Iron 3. Lead 4. Silver

(Continued)

31 Which one of the following scientists did not participate in inventing or improving the steam engine: (Technology). 1. Hero 2. James Watt 3. Fulton *4. Archimedes
32 Small calculators, computers and electrical storage depend in their manufacture on: (Technology). 1. The Cylinder 2. The Piston 3. The Fuel room *4. The Transistor
33. The turbine engine consists of three parts. Which of the following is not regarded as a part of the turbine engine? (Technology). *1. Piston 2. Fuel room 3. Cylinder 4. Gaseous Turbine
34. The rocket consists of three parts. Which of the following is not regarded as a part of the rocket? (Communication). 1. Fuel room 2. Burning room *3. Piston 4. Gaseous Turbine
35. Who invented the Telephone? (Communication). 1. Hero *2. Graham Bell 3. Stevenson 4. Watt
36. Which one of the following factors does not lead to technological development? (Communication). 1. Availability of scientists and engineers. 2. The availability of energy sources (oil, gas and electricity. 3. The availability of financial resources (money etc) *4. Shortage of skills and specialists.

* Indicates the correct answer for each item.

ATTITUDE TO SCHOOL, SELF-ACHIEVEMENT MOTIVATION, SCIENCE SELF-CONCEPT AND SELF-CONCEPT QUESTIONNAIRE

DIRECTIONS:

The purpose of this questionnaire is to find out your attitudes towards school, self-achievement motivation, science self-concept. Remember that this questionnaire does not have anything to do with your exam or your school marks in general. What is required is to show your attitudes as accurately as you perceive them. Always remember that there is no wrong or right answer. Your opinion is required for each of the statements.

There are, as you can see, five possible answers. These are:

Strongly Agree: If you strongly agree with this statement.

Agree : If you agree with this statement.

Not sure : If you are not sure about this statement.

Disagree : If you disagree with this statement.

Strongly Disagree: If you strongly disagree with this statement.

EXAMPLE

I Like my Family SA A NS DA SD

Please ring the appropriate response; in this case A is ringed because the person agrees with this statement.

Scale	SA	A	NS	DA	SD
ATTITUDE TOWARDS SCHOOL 1. Most teachers at this school are fair with students 2. I feel like I am in prison when I am at school 3. I am under great pressure at school					
SELF ACHIEVEMENT MOTIVATION 1. I always try hard no matter how difficult the school work. 2. When I fail that makes me try that much harder. 3. I always try to do my best in school. 4. I try hard to do well in science.					
SCIENCE SELF-CONCEPT 1. I consider myself a good science student. 2. I think I am capable of becoming an engineer, doctor.					

ATTITUDE TOWARDS SCIENCE IN SCHOOL ASSESSMENT

DIRECTION:

The purpose of this questionnaire is to show your attitudes towards science. Remember that this questionnaire does not have anything to do with your exam or your school marks in general. What is required is to give your attitude as accurately as you can. Always remember that there is no wrong or right answer. Your opinion is required for each of the statements.

There are, as you can see, five possible answers. These are:

Strongly Agree: If you strongly agree with this statement

Agree : If you agree with this statement

Not sure : If you are not sure about this statement

Disagree : If you disagree with this statement

Strongly Disagree: If you strongly disagree with this statement

EXAMPLE:

Mathematics is interesting SA AG NS D SD

Please ring the appropriate response; in this case the person agrees with statement.

Item	SA	A	NS	DA	SD	NEG/POS
1. Science is fun.						+
2. I do not like science and it bothers me to have to study it.						-
3. During science class, I usually am interested						+
4. I would like to study more about science.						+
5. If I knew I would never go to science class I would feel sad.						+
6. Science is interesting to me and I enjoy it.						+
7. Science makes me feel uncomfortable, restless, irritable, and impatient.						-
8. Science is fascinating and fun.						+
9. The feeling that I have towards science is a good feeling.						+
10. When I hear the word science, I have a feeling of dislike.						-
11. Science is a topic which I enjoy studying.						+
12. I feel at ease with science and I like it very much.						+
13. I feel a definite positive reaction to science.						+
14. Science is boring.						-

INTEGRATED SCIENCE STUDENT PERCEPTION QUESTIONNAIRE

Dear Student:

Please answer all questions. For your information, this questionnaire does not have anything to do with your final grades. And this questionnaire(s) will not be shown to your science teacher(s) or any person in or outside school. The purpose of this test is to collect data for my postgraduate research.

DIRECTIONS:

You will see statements about your science teacher's behaviour before and during science classes. All you have to do is to remember exactly what happened when you see a matching statement and give your opinion as well as you can by putting....in the box beside the statement. Remember that there is no right answer. All that is needed is your opinion.

There are, as you can see, three Alternative answers:

Agree: If you agree that this is typical behaviour of your science teacher during your science lessons.

Not sure: If you are not sure that this is typical behaviour of your science teacher during your science lessons.

Disagree: If you disagree that this is typical behaviour of your science teacher during your science lessons.

EXAMPLE:

This Science Teacher is Friendly Ag N.S Dis

ITEM	AGREE	NOT SURE	DISAGREE
Characteristics Associated with Pre-classroom Behaviour			
1. This science teacher knows the subject very well.			
2. This science teacher presents the main ideas in an organised and integrated way.			
3. This science teacher makes adequate plans for the laboratory activities.			
4. This science teacher conducts the laboratory activities confidently.			
5. This science teacher collects all the nece-ssary materials for laboratory activities.			
6. This science teacher carries out laboratory activities successfully.			
7. This science teacher gives satisfactory explanations to students' questions.			

ITEM	AGREE	NOT SURE	DISAGREE
Characteristics Associated with Teacher Classroom Behaviour			
8. This science teacher uses simple and clear words when explaining a lesson.			
9. This science teacher asks questions during a lesson to hold our attention.			
10. This science teacher gives us a chance or a clue when answering questions.			
11. This science teacher uses enough audio-visual aids to make a lesson clear.			
12. This science teacher asks questions during practical work to make sure we understand what he is doing.			
13. This science teacher asks questions at the end of each lesson.			
14. This science teacher summarises and goes over the main ideas of a lesson before the end.			
15. This Science explaines the steps to be taken in an experiment before asking us to do experiments.			
16. This science teacher does not go over examination papers after they have been marked and does not discuss the results with us.			

ITEM	AGREE	NOT SURE	DISAGREE
17. This science teacher does not let us experiment on our own as often as we should wish.			
18. This science teacher does not use homework marks to find out if we need more help in understanding our work.			
19. This science teacher asks questions around the classroom so that we cannot predict who is going to be asked.			
20. This science teacher gives us a chance to do experiments by ourselves.			
21. This science teacher does not like us asking him questions.			
22. This science teacher moves from one subject to another before making sure that we all have understood the previous one.			
23. This science teacher presents the main ideas in a lesson in a way that is easy to follow.			
24. This science teacher finds different ways of teaching science to interest us in the subject.			
25. This science teacher asks more questions than are included in our textbooks.			

ITEM	AGREE	NOT SURE	DISAGREE
26. This science teacher makes sure we only use observations and results from our exper-Iments as the basis of our thinking and conclusions.			
27. This Science does not allow us to do enough practical work on our own.			
28. This science teacher finishes topics and experiments in good time before the end of lessons.			
29. This science teacher spends too much time giving us facts and information instead of practical experimental work.			
30. This science teacher does not ignore our ideas but makes use of them in discussions.			
31. This science teacher invites and values various points of view from us.			
32. This science teacher is very keen on what he/she teaches.			
Characteristics Associated with Teacher Classroom Personality.			
33. This science teacher notices when we are not paying attention or misbehaving and stops us.			

ITEM	AGREE	NOT SURE	DISAGREE
34. This science teacher permits our discussions to wander too far from the subject.			
35. This science teacher very often comes late to the classroom.			
36. This science teacher does not attend all his classes.			
37. This science teacher does not notice us cheating during lessons and in the examinations.			
38. This science teacher permits us to show reasonable signs of humour.			
39. This science teacher wastes a great deal of lesson time on things not connected with the lesson.			
40. This science teacher orders us around all the time for no particular reason.			
41. This science teacher has a sense of humour.			
42. We can depend on this science teacher to hold activities as planned.			
Characteristics Associated with Teacher Classroom Attitude			
43. This science teacher does not let personal problem interfere with his treatment of us.			
44. This science teacher punishes the whole class when one or two of us do something wrong.			

Item	Agree	Not Sure	.Disagree
45. This science teacher does not make fun of us for giving wrong answers. 46. This science teacher does not make us feel he is proud of us. 47. This science teacher trusts and respects us. 48. This science teacher deducts marks from our work to punish us. 49. This science teacher is fair in marking, assignments homework and examination. 50. This science teacher behaves in the same way towards all of us regardless of how good we are at science.			

APPENDIX B

Frequencies of Student Responses to Attitude Towards Science in School Assessment.

Item	SA	A	NS	DA	SD
1. Science is fun.	72	112	90	468	387
2. I do not like science and it bothers me to have to study it.	56	138	110	506	319
3. During science class, I usually am interested	27	68	129	510	395
4. I would like to study more about science.	49	111	105	408	456
5. If I knew I would never go to science class I would feel sad.	96	215	199	356	263
6. Science is interesting to me and I enjoy it.	47	102	118	456	406
7. Science makes me feel uncomfortable, restless irritable, and impatient.	87	140	149	470	283
8. Science is fascinating and fun.	87	142	149	404	347
9. The feeling that I have towards science is a good feeling.	44	124	126	468	367
10. When I hear the word science, I have a feeling of dislike.	68	105	136	480	340
11. Science is a topic which I enjoy studying.	47	126	161	461	334
12. I feel at ease with science and I like it very much.	46	146	146	435	356
13. I feel a definite positive reaction to science.	40	134	233	414	308
14. Science is boring.	123	114	128	383	381

Frequencies of Student Responses to SAM School Achievement Motivation.

Scale	SA	A	NS	DA	SD
1. Most teachers at this school are fair with students.	72	87	216	389	365
2. I feel like I am in prison when I am at school	56	109	166	410	388
3. I am under great pressure at school	53	125	143	492	316
4. I always try hard no matter how difficult the school work.	24	89	127	463	426
5. When I fail that makes me try that much harder.	30	49	91	348	611
6. I always try to do my best in school.	13	69	94	442	511
7. I try hard to do well in science.	43	187	173	445	281
8. I consider myself a good science student.	61	107	237	395	329
9. I think I am capable of becoming an engineer, doctor.	109	160	307	252	301

Frequencies of Student Responses to the Science Achievement Test

ITEM	OPTIONS			
	A	B	C	D
1	55	25	*1043	6
2	*221	781	90	37
3	*932	35	132	30
4	37	21	*1067	4
5	*1011	61	64	3
6	79	*895	82	73
7	136	128	166	*699
8	179	111	*653	186
9	*880	117	106	26
10	111	108	59	*851
11	40	35	75	*979
12	83	120	*834	92
13	147	119	*784	79
14	370	39	*684	38
15	179	*515	132	303
16	*952	107	28	42
17	71	*815	159	84
18	92	*972	28	37
19	3	10	25	*1091
20	83	26	*985	35
21	*645	165	154	165
22	302	92	154	*581
23	122	209	43	*755
24	14	120	9	*986
25	162	*595	119	253
26	36	88	*924	81
27	62	*857	133	77
28	*1025	82	11	11
29	*862	159	51	57
30	84	*851	121	73
31	52	52	128	*897
32	192	175	135	*627
33	176	98	*588	267
34	81	84	*606	358
35	87	*930	71	41
36	134	166	103	*726