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The purpose of this study was (a) to develop a valid and reliable attitude toward science instrument for use with Arabic male students at the secondary school level, (b) to determine the differences in their attitudes toward science and in their achievement, and (c) to determine the relationship between measures of these attitudes toward science and the students' achievement in chemistry and physics. The subjects consisted of 115 tenth grade students, 109 eleventh grade students, and 110 twelfth grade students who were enrolled in eight secondary schools in Riyadh, Saudi Arabia.

The attitude toward science instrument was developed and translated into the Arabic language. Students were pretested at the beginning of the term in

1986, and posttested at the end of the same term. The reliabilities of the instrument was calculated using the Hoyt and Stunkard technique and was found to be .66 and .61 respectively on the pretest and posttest. Two-way analysis of covariance was used to analyze test scores. Multivariant analysis of covariance was used to analyze achievement test scores in physics and chemistry. Pearson-product-moment correlation was used to find the relationship between attitude toward science and science achievement.

Results revealed significant differences in (a) attitudes toward science between Saudi and non-Saudi Arab male students, with Saudi attitudes more positive, and (b) chemistry achievement, with non-Saudi students achieving at higher levels. A strong positive correlation ($r = .75$) was found between achievement in chemistry and physics. No significant differences were found in comparison of nationality and grade levels, physics achievement, and attitudes across grade levels.

It was concluded that Saudi and non-Saudi secondary students in Riyadh, Saudi Arabia, have generally negative attitudes toward science, although attitudes of Saudi Arabic students are more positive than those of non-Saudi counterparts. However, non-Saudi subjects demonstrate higher achievement in chemistry.

# SAUDI AND NON-SAUDI ARAB MALE STUDENTS' ATTITUDES TOWARD SCIENCE AND SCIENCE ACHIEVEMENT IN SECONDARY SCHOOLS, RIYADH, SAUDI ARABIA

by

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## CHAPTER I

## INTRODUCTION

One of the purposes of science education is to foster positive attitudes, particularly toward science. The integration of cognitive with affective domains is useful and effective in studying students for their interests and needs in terms of planning teaching methods that could provide them with many opportunities to develop their attitudes (Raghukin, 1979).

According to Gardner (1975), "the development of cognitive abilities in science is not enough. The ultimate aims of science education include attitudes as well" (p. 1). The importance of attitudes toward science has led many writers to define them in a variety of ways. According to Blosser (1984), "Some researchers appear to be investigating scientific attitudes while others study attitudes toward science" (p. 2). Attitudes toward science always have "some distinct attitude object to which the respondent is invited to react favorably or unfavorably" (Gardner, 1974, pp. 1-2), whereas scientific attitudes have two "main dimensions - the scientific and the affective. The first one refers to the nature of the scientific attitude as it relates to the nature of scientific activity, while the second refers to its affective or attitudinal characteristics" (Gauld and Hukins, 1980, pp. 131-132).

In order to focus on attitude toward science, it is necessary to distinguish between attitudes toward science and the scientific attitudes. The difference between scientific attitudes and attitudes toward science was described by Munby (1983) as follows:

> Scientific attitudes are thought to represent habits of mind. Attitudes toward science are quite distinct from these, for they capture such notions as feelings toward science, interest in pursuing a science-related career and beliefs about the relationship between science and technology. (pp. 21-22)

Different definitions have been suggested by many writers to define scientific attitudes. Such examples were "feelings and likings for science courses and activities" (Hasan, 1985; p. 4) or "desirable traits, characteristics, or attributes of scientists at work" (Krynowsky, 1985, p. 13).

Attitudes toward science refers to "how an individual feels about science; an emotional feeling for or against science" (Dutton and Stephens, 1983, p. 43). Koballa and Crawley (1985) viewed attitudes toward science as a general and enduring positive or negative feeling about science.

Although much has been written about the importance of curricula in promoting positive attitudes toward science, Saudi science curricula tend to lack the affective domain to some degree. According to Al-Rasheed (1983) "science curricula in the secondary stage are not designed to develop the affective behavior of students" (p. 7). According to Kurnas (as cited by Al-Rasheed, 1983), "The Saudi Arabian Laboratory physics activities in grade 12 are not designed to

develop the affective and psychomotor abilities of the students" (p. 7).

## Rationale for the Study

Historically, emphasis in the science and liberal arts curriculum at all educational levels has been on the learning of content. Recently, educators have realized the need to place more emphasis on attitudes, particularly attitudes toward science.

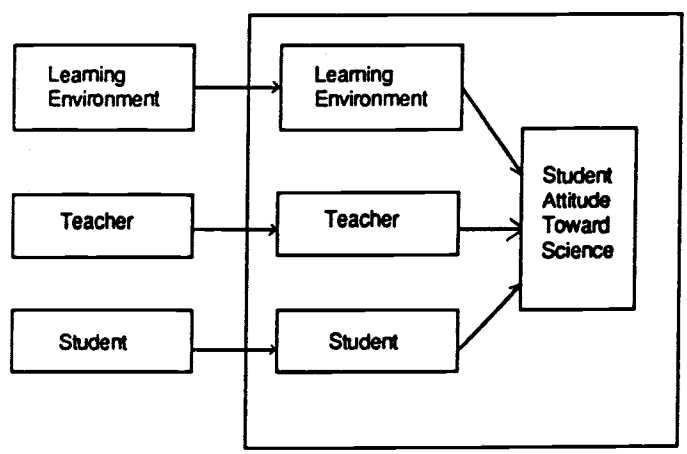
The relationship between attitudes toward science and science achievement has been studied by many (Alvord, 1972; Hough & Piper, 1982; Littlefield, 1975; Simpson and Mitchell, 1982; Butzow and Drake, 1977: Raghubir, 1979; Mallon and Bruce, 1982). Alvord (1972) found a significant correlation between attitudes toward science and science achievement. Hough and Piper (1982) investigated the relationship between elementary pupils' attitudes toward science and their science achievement using the residualized gain scores. Their findings showed that there was a significant relationship between the pupils' residualized gain scores on the "Hough Pupil Process Test" and their residualized gain scores on the "Hough Attitude Inventory." They reported the existence of a strong relationship between attitudes toward science and science achievement when residualized scores are used. Littlefield (1975) found out that high achievers, when contrasted to low achievers, had more positive attitudes toward science. Simpson and Mitchell (1982) found a weak relationship between attitude toward biology and cognitive measures among college biology students. Butzow and Drake (1977) studied the interrelations of attitudes and

achievement measures in an audio-tutorial college chemistry course. Their findings revealed a weak relationship between attitudes and course achievement.

It appears that some Saudi students as well as non-Saudi Arabic students who attend school in Saudi Arabia do not achieve well in science. Modernization and the social changes seem to be factors that underlie differences in science learning. Some other factors that might contribute are the nature of science laboratory and teaching method in Saudi secondary schools. As John Dewey said, "The best learning is by doing." Laboratory science in Saudi schools is very far from being satisfactory, and most science classrooms are ill-equipped. Emphasis is not on learning by doing.

The traditional lecture teaching method is widely used in most Saudi schools. Few teachers are enthusiastic about innovation; others are hesitant, because they did not learn by doing when they were students in the science classroom.

The theoretical framework for the study of attitude toward science is derived from Haladyna and Shaughnessy.




Framework of the Model

Three independent constructs are posed: teacher, student, and learning environment. Each of these constructs can be explained more specifically in terms of classes of variables. The relationships among these classes of variables can be simply expressed as

$$Y = F(A,B,C)$$

where:

- Y represents the criterion measure, attitudes toward the subject matter of science;
- F is a function of a student, teacher, and learning environment variables;
- A represents student variables;
- B represents teacher variable; and
- C represents learning environment variables.

All variables can be classified into one of the two categories: exogenous and endogenous. Exogenous variables are those outside the immediate influence of the educational process, for example, age of the student, sex of the student, family background, cultural factors, and the like. Endogenous variables are those within the system under the control of the educational process and its agents, specifically, teacher, parents, and school administration. For the most part, the framework suggests that the teacher is the primary change agent in affecting the learning environment, and these two constructs, the teacher and the learning environment, work in concert to change attitudes.

The proposed study will investigate whether there is a difference between Saudi and Arab students in attitudes toward science and science achievement.

The student variable will be derived from the theoretical framework as one of the independent variables.

## Background to the Problem

Any educational policy in any country is concerned with the child's development, mentally, psychologically and emotionally, toward becoming a good productive citizen. Schools generally reflect this policy according to the available sources and efforts an educator might supply. Most countries are concerned with students' achievement and attitudes toward science. These concerns have caught the attention of many writers from all over the world including (Haladyna, Olsen and Shaughnessy (1980), Wareing (1981), Ward (1976), and Simpson and Oliver (1985). Attitude studies in Saudi Arabia are in their infancy. Only the studies by Al-Hemaisan (1985), Al-Faleh (1983), and Al-Rashed (1984) have focused on the relationship between science achievement and attitudes. These studies have contributed to the understanding of students' attitudes in different stages in public education, but more research is needed.

Saudi science curricula in secondary schools concentrate on the cognitive domain as a major goal. Little attention is focused on the affective domain, which might enhance gains in the cognitive domain. This study attempts to answer the question of whether there is a significant difference in attitudes toward science and achievement in the chemistry and physics classroom

between Saudi and non-Saudi Arabic students attending secondary school in Saudi Arabia Riyadh. It is an extension of previous studies conducted in Saudi Arabia on the relationship between science achievement and attitude toward science.

## Statement of the Problem

The purpose of this study is to determine students' attitudes toward science and science achievement in chemistry and physics, and to examine the possible relationship between attitudes and science achievement among Saudi students in grades 10, 11, and 12. In other words, the problem being investigated is as follows: (a) to develop a valid and reliable attitude toward science instrument for use with Arabic students at the secondary school level, (b) to determine differences in attitudes toward science and achievement in physics and chemistry in grades 10, 11, and 12 between Saudi and non-Saudi Arabic students in secondary schools in Riyadh, Saudia Arabia, and (c) to determine the relationship between measures of students' attitudes toward science and achievement in physics and chemistry in grades 10, 11 and 12.

## Research Hypotheses

1. There is a significant difference in attitudes toward science in terms of national origin and grade level between Saudi and non-Saudi Arabic students at

the secondary level.

2. There is a significant difference in chemistry achievement between Saudi and non-Saudi Arab students in grades 10, 11, and 12 living in Saudi Arabia.

3. There is a significant difference in physics achievement between Saudi and non-Saudi Arabic students in grades 10, 11, and 12.

## Assumptions

1. The Delphi technique is a valid approach for validation of an attitude-toward-science instrument.

2. Based on the culture, Saudi and non-Saudi Arab students living in Saudi Arabia have similar academic backgrounds in science.

3. The tests developed by science teachers and Riyadh Educational Directorate to measure achievement were valid and reliable.

## Limitations

1. The study is limited to Saudi and Arab male students, attending different secondary schools in Riyadh, Saudi Arabia.

2. The study is limited to eight secondary schools in Riyadh, Saudi Arabia.

3. The study was limited to students taking physical science courses in grades 10, 11, and 12.

## Delimitations

1. The study does not focus on science teachers in secondary schools in Riyadh.
2. No attempt is made to evaluate the effectiveness of science instruction.

## Definitions of the Terms

1. Secondary education refers to grades 10, 11, and 12 of public pre-college education in Riyadh, Saudi Arabia.
2. Secondary schools students refers to Saudi and non-Saudi students attending grades 10, 11 and 12 at secondary schools in Riyadh, Saudi Arabia.
3. Non-Arab students refers to students from other Arab countries like Egypt, Syria, Palestine, Jordan and Sudan, who are attending secondary schools in Riyadh, Saudi Arabia.
4. Attitude as defined by Rockeach (1968), is a "relatively enduring organization of beliefs around an object or situation predisposing one to respond in some preferential manner " (p.112).
5. Attitude toward science refers" to how an individual feels about science; an emotional feeling for or against science" (Dutton and Stephans, 1983, p. 43).
6. Achievement refers to progress in school, which is measured by the score on the teacher made test.
7. Science achievement is defined as the scores on science achievement

tests in chemistry and physics.

## Methodology

The attitudes toward science instrument was developed and modified from a list of items found in previously developed attitude toward science instruments. The content validity was determined by a group of experts in the field of science education. In October 1986, a pilot study was conducted using the first draft of the inventory. The target group consisted of 90 Saudi and non-Saudi students in grades 10, 11, and 12. Permission was sought to conduct the study through Saudi Arabia Educational Mission in Costa Mesa, California.

The attitude toward science instrument was administered as a pretest to students in grades 10, 11, and 12 at eight secondary schools in Riyadh at the beginning of the first term of 1986. At the end of the term the instrument was administered as a posttest. Achievement tests developed by the teachers in chemistry and physics were administered as posttests as well. Three statistical procedures were used to analyze the data. A two-way analysis of covariance was used to determine differences in attitudes among Saudi and non-Saudi Arabian students in grades 10, 11, and 12. Multivariate Analysis of covariance was used to determine differences in physical science achievement between the two groups. Finally, the Pearson-moment-product Correlation was used to determine the relationship between attitudes toward science and science achievement.

## Organization of the remainder of the study

Chapter II is devoted to the background and related literature and is divided into five sections. Section one presents the development of education in Saudi Arabia. Section two covers attitudes. Section three presents a discussion of scientific attitudes. Section four is devoted to attitudes toward science. The relationship between attitudes toward science and science achievement is examined in section five. Chapter III presents the methodology of the study. The analysis and interpretation of the findings are reported in chapter IV. Summary, conclusions, and recommendations are presented in chapter V.

# CHAPTER II

# REVIEW OF THE LITERATURE

This chapter is organized into five sections. Section one presents the development of education in Saudi Arabia. Section two covers attitudes. Section three presents a discussion of scientific attitudes. Section four is devoted to attitudes toward science. The relationship between attitudes toward science and science achievement is examined in section five.

## Development of Education in Saudia Arabia

Formal education in Saudi Arabia began in 1926, when the Saudi Scientific Institute was established for postelementary studies. "The purpose of that institution was to prepare and to provide the government agencies with officials" (Al-Zaid, 1982, p. 21). Before that time, there were only private schools whose purpose was for students to recite and memorize Quran. These schools were located in Mosques and in the houses where religious people lectured on the subject matter being taught, such as Quran, mathematics, and the Arabic language. According to Filemban (1982), "the teacher did not utilize many indirect statements while teaching. The most common indirect statements were questions about the lesson of the students" (p. 17).

The Ministry of Education is responsible for providing formal education,

which includes elementary education, intermediate education, secondary education, vocational education, and special education. According to Filemban (1982), when the Ministry of Education was formed in 1954, "the government adopted a six year elementary cycle, a three year intermediate cycle, and a three year secondary cycle, according to the school system set by the Arab League" (p. 18).

Education in Saudi Arabia is noncompulsory, noncoed, and free for both boys and girls from elementary to the university level. Education for women, did not exist until 1960, marking the beginning of the development of women's education. The Directorate General of Girls' Schools is the official organization responsible for girls' education. According to Filemban (1982),

> Since 1964, several intermediate schools specializing in nursing education and theology, have been developed for girls to expand their education to the secondary and university level. Women are now allowed to go abroad to complete bachelor degrees. Women are even encouraged to take degrees in medicine which, even in the United States, has been a traditionally male dominated career field. (p. 23)

Saudi's present educational system is based on the Islamic religion with the characteristics of western education superimposed upon it.

Elementary Education

Elementary education is noncompulsory. The period of study is six years leading to the General Certificate of Elementary Education. It is designed to the child's development within the framework of Islamic religion, basic knowledge, and experience. Children take courses such as religion, Arabic, history, geography, and mathematics. According to the Educational policy, the goals of elementary education (as cited by Al-Zaid, 1982) are as follows:

1. Implanting the true Muslim faith in the heart of a child and raising him according to Muslim ways with complete manifestation of such features in his character, body, mind, language and identification with the Muslim nation.
2. Training a student to perform prayers and observe the rules of conduct and good morals.
3. Developing in the student, the various basic skills, particularly language, arithmetical, and physical skills.
4. Providing the student with a suitable amount of information in various subjects.
5. Acquainting him with the blessings bestowed by God on him and on his social and geographical environment, so as to make good use of such gifts and let them be of benefit to him and to his environment.
6. Cultivating his aesthetic taste, nurturing his creative activities, and building in him a sense of appreciation for his manual work.

7. Developing his talents so as to be aware of his duties and right within the limits of his age and the special particularities of the stage in which he is passing, and in calculating in him the love for his fatherland and loyalty to his superiors, who are charged with authority.
8. Generating a desire in the student to seek more useful knowledge, learn serviceable work, and benefit from his leisure time.
9. Preparing a pupil for that phase of life which is to follow his present one. (p. 46-47)

## Intermediate Education

Intermediate education is a stage that provides students with skills and knowledge suitable for his age, needs, interests, and the principles to prepare him for secondary school. It is a stage in which students develop their faith, their minds, and their bodies (Al-Zaid, 1982, p. 47). In this stage, students take Arabic language, history, literature, mathematics, and science. According to Filemban (1982),

> Admittance to intermediate school is by competitive examination. These tests are given on the same day each year. The pressure on the boys to do well and the coinciding stress that it includes has been a major factor in the government's interest in finding a new way to screen out students. (p. 19)

According to the Educational policy (as cited by Al-Zaid, 1982), the goals of intermediate education are as follows:

1. Strengthening the Islamic faith in the soul of a student and making it serve as a controller of his conduct and behavior as well as a developer of his love, devoutness and fear of God.
2. Providing him with experience and knowledge suitable for his age, so as to get familiar with the general foundations and basic principles of culture and science.
3. Arousing his desire for seeking knowledge and habituating him to mediation and scientific study.
4. Developing the mental faculties and various skills of a student and attending to such faculties and skills through proper guidance and instruction.
5. Educating him according to the Islamic social life, which is characterized by brotherliness, cooperation, performance of duty, and sense of responsibility.
6. Training him to serve his society and fatherland, and developing in him a spirit of sincerity and loyalty to his superiors.
7. Promoting his zeal for the restoration of the glories of his Muslim nation, to which he belongs, and for the resumption of the march along the path of glory and honor.
8. Cultivating in him the habit of using his time in good reading, of utilizing his leisure time in beneficial work, and of carrying out his

activities in such manner as to make his Islamic personality richer and stronger.

9. Strengthening a sense of awareness in a student, so as to let him know, according to the level of his age, how to face misleading rumors, destructive doctrines, and alien thoughts.

10. Preparing him for the phase of life to follow his present one. (pp. 47-49)

## Secondary Education

The first secondary school in Saudi Arabia was opened in 1926 under the name of The Saudi Scientific Institute (Saudi Elmi Institute). The purpose of that school was to prepare students to be teachers at the elementary level. The duration of study was four years. The first year was a preparatory year in order to recognize those students' who are capable of being teachers (Ministry of Education, 1982). According to Al-Hussain (1983): "Some years later, the education agency changed the name of that school, so that it became a general secondary school. It then covered the six years of the study after elementary school" (p. 6).

Modern secondary education started in 1938 with the establishment of the School of Abroad Preparation. The purpose of that school was to prepare students to complete their education at the university level. The duration of study was five years. Nine years later,

the duration of study was raised to six years. Students were classified into two sections: the Science Section, which included chemistry and physics; and the Humanities Section, which included the Arabic language, English, psychology, religion, French, and history. This system was continued until 1959 (Ministry of Education, 1982). Secondary education was then separated into two stages, each of which has its own system. The first stage is "the intermediate stage." The duration of study is three years, leading to the General Certificate of the Intermediate education. The second stage is "the secondary stage." The duration of that is three years, leading to the General Certificate of Secondary Education. According to Al-Mazyed (1975),

> In addition to taking biology, chemistry, and physics, students entering the science section were required to specialize in one of these science subjects or in mathematics. The specialty of subjects was taught three times a week to the second and third grades. In 1963, one weekly period of geology was added to the science curriculum of the second and third grades of the secondary science section. As a result of this addition, the number of periods of the additional science or mathematics specialty subject was reduced from three to two periods a week. (p. 51)

The tenth grade in Saudi secondary schools is a transitional one in which students have the options of majoring in science or liberal arts. Upon successful completion of that stage, which includes courses in different areas, the students

have two options in the eleventh grade. According to Al-Hussain (1983),

> In the second year, the student will select either the science or the humanities section, which determines much of the future course requirements. The science section offerings are: religion, Arabic language, science, mathematics, English, and physical education. The humanities section offerings are the same as the science section, except that mathematics and science courses are replaced by psychology, sociology, geography, history, and intensive language study. The focus in humanities is on literacy subjects, while the science section concentrates mainly on scientific subjects, including biology, chemistry, physics and geology. (p. 7)

These two sections provide many opportunities according to the student's interests and abilities. Tables 1, 2, and 3 show the major topics of grades 10, 11, and 12. Figure 2 shows the structure of the general secondary education.

## The Comprehensive Secondary Schools

To improve secondary education, a new reform was started in 1975/1976 by opening the first comprehensive secondary school in Riyadh, known as "Al-Yarmouk Secondary Comprehensive School." The number of these schools has increased to four in the major cities in Saudi Arabia. Students are required to complete 150 hours on the semester system in order to graduate.

Figure 1

Third: Secondary School Program
The study term of this state is three years, during which a student will study the following subjects:
Number of Weekly Hours Attended by a Student

| First Year Subject | Second Year Arts/Science | | Third Year Arts/Science | | Arts/Science | | Remarks |
|---|---|---|---|---|---|---|---|
| Islamic Prophet's Courses | 4 | 4 | 4 | 4 | 4 | 4 | The Quran, Sayings, Islamic, Fundamentals, Elementary Jurisprudence |
| Arabic | 9 | 9 | 11 | 4 | 11 | 3 | Grammar, Literature, Phraseology, Reading, criticism, Rhetoric (for Arts Section) |
| Social Studies | 4 | 4 | 8 | | 8 | | History, Geography Psychology, Sociology |
| Mathe-matics | 3 | 4 | | 9 | | 9 | Geometry, Algebra, Arithmetic |
| Science | 6 | 6 | | 12 | | 12 | Physics, Chemistry, Biology |
| Physical Education | 1 | 1 | 1 | 1 | 1 | | |
| English Language | 7 | 7 | 6 | 6 | 6 | 6 | |
| General Activities | 1 | 1 | | | | | |
| Total Weekly Hours Per Subject | 36 | 36 | 36 | 36 | 36 | 36* | |

*Ministry of Education instructions communicated to schools regarding the secondary education play. Source: Al-Zaid, A. (1982). Education in Saudi Arabia: A model with a difference. Jeddh: Tihama.

TABLE 1
Major Topics of Grade 10 Physics, Chemistry, and Biology

| Physics[a] | Chemistry[b] | Biology[c] |
|---|---|---|
| ISLAM AND SCIENCE | ATOMIC THEORY DEVELOPMENT | LIFE AND LIVING THINGS |
| Attitudes of Islam toward science | Nature of matter | NUTRITION AND TRANSPORT |
| Muslim contribution to science | Atom's history | Human nutrition |
| PROPERTIES OF MATTER | Modern atomic theory | Human circulatory system |
| Elasticity | PERIODIC CHART AND GROUPS IA TO IIIA | Plant nutrition and transport |
| Delinquenscents | Alkali metals and earth alkali metals | RESPIRATION |
| Atmospheric pressure | Groups AIII and AIV | Human respiration |
| Properties of liquids | ORGANIC CHEMISTRY | Plant respiration |
| HEAT | History of organic chemistry | EXCRETION |
| Heat and its sources | Chemical formulas | Human excretion |
| Measuring temperature | HYDROCARBONS | Plant excretion |
| Expansion of solid bodies | Alkanes | REPRODUCTION |
| Expansion of liquids | Alkanes and alkynes | Animal reproduction |
| Thermal properties | Cyclic hydrocarbons | Plant reproduction |
| Gasses | Alcohols | SENSES |
| Heat quality | Carboxylic acids | Human senses |
| Change of state | | Plant senses |
| Heat and work | | CELL AND HEREDITY |
| | | Cell division |
| | | Heredity |
| | | Human heredity |

[a]Topics were obtained from the table of contents of the Grade 10 Physics Textbook, 2nd ed. (Riyadh, Saudi Arabia: Ministry of Education, 1977).

[b]Topics were obtained from the table of contents of the Grade 10 Chemistry Textbook, 1st ed. (Riyadh, Saudi Arabia: Ministry of Education, 1975).

[c]Topics were obtained from the table of contents of the Grade 10 Biology Textbook, 1st ed. (Riyadh, Saudi Arabia: Ministry of Education, 1975).

Source: Al-Rashed A.A. (1983), An investigation of the general affective behavior toward science held by secondary school scientific section students at Riyadh City, Saudi Arabia. Unpublished doctoral dissertation, University of Northern Colorado, Greeley (p. 22).

TABLE 2
Major Topics of Grade 11 Scientific Section
Physics, Chemistry, Biology, and Geology

| Physics[a] | Chemistry[b] | Biology[c] | Geology[d] |
|---|---|---|---|
| MECHANICS<br>Forces acting on one plane<br>Parallel forces<br>Motion on a straight line<br>Falling objects<br><br>WAVE MOTION AND SOUND<br>Oscillatory motion & wave motion<br>Nature & properties of sound<br>Vibration of strings<br>Resonance<br><br>LIGHT<br>Nature of light<br>Light reflection<br>Light refraction<br>Optical instruments<br><br>STATIC ELECTRICITY<br>Electric charge<br>Electric field & potential<br>Electric capacity & electric condensers & instruments | ATOMIC THEORY AND PERIODIC CHARTS<br>Modern atomic theory<br>Electronic configuration<br>Chemical bonds<br>Transaction elements<br><br>AIR & WATER<br>Chemistry of air<br>Chemistry of water<br><br>SOLUTIONS<br>Concentration of solutions<br>Types of solutions<br><br>STOICHIOMETRY<br>Chemical reaction & weight calculation<br>Chemical reaction<br>Gases<br><br>ORGANIC CHEMISTRY<br>Hydrocarbonic substances<br>Petroleum<br>Industrial organic substances | CELL AND ITS ACTIVITIES<br>Chemical structure & physical properties<br>Protoplasm<br>Bioactivities of the cell<br><br>HEREDITY<br>Genes<br>Human chromosomes<br>Improvement of animal & plant production<br><br>CLASSIFICATION OF ORGANISMS<br>Monera kingdom<br>Protista kingdom<br>Plant kingdom<br>Animal kingdom<br><br>ECOLOGY<br>Ecological factors & the relations between organisms<br>Ecology & living<br>Natural equilibrium & environmental pollution | PRINCIPLE INFORMATION ABOUT GEOLOGY<br><br>THE NATURE OF THE EARTH MATERIALS<br><br>ROCKS<br>Igneous rocks<br>Sedimentary rocks<br>Metamorphic rock<br><br>GEOPHYSICS<br>Erosion<br>Sedimentation<br>Ground water as geological factor<br>Sea water as geological factor<br>Tectonic geology |

[a]Topics were obtained from the table of contents of the Grade 11 Scientific Section Physics Textbook, 2nd ed. (Riyadh, Saudi Arabia: Ministry of Education (1979).

[b]Topics were obtained from the table of contents of the Grade 11 Scientific Section Chemistry Textbook, 2nd ed. (Riyadh, Saudi Arabia: Ministry of Education, 1979)

[c]Topics were obtained from the table of contents of the Grade 11 Scientific Section Biology Textbook, 2nd ed. (Riyadh, Saudi Arabia: Ministry of Education, 1979).

[d]Topics were obtained from the current official curriculum of the secondary stage (Riyadh, Saudi Arabia: Ministry of Education, 1974), pp. 281-84.

Source: Al-Rashed A.A. (1983), An investigation of the general affective behavior toward science held by secondary school scientific section students at Riyadh City, Saudi Arabia. Unpublished doctoral dissertation, University of Northern Colorado, Greeley (p. 23).

TABLE 3
Major Topics of Grade 12 Scientific Section
Physics, Chemistry, Biology, and Geology

| Physics[a] | Chemistry[b] | Biology[c] | Geology[d] |
|---|---|---|---|
| MECHANICS<br>Equilibrium<br>Newton's Laws<br>Work & energy & principles of energy conservation<br>GEOLOGY<br>Circular motion & simple harmonic motion<br>Wave motion<br><br>ELECTRICITY & MAGNETISM<br>Electrical current uses & sources<br>Principle of charge & energy conservation<br>Magnetism<br>Electrical gauges & instruments<br>Electromagnetic waves<br><br>AUTOMIC & NUCLEAR PHYSICS<br>Structure of matter<br>Atom & quantum theory<br>Quantum theory & wave function<br>Nuclear stability | CHEMICAL REACTION RATE & EQUILIBRIUM<br>Chemical reaction rate<br>Chemical equilibrium<br><br>IONIC THEORY & AQUEOUS SOLUTIONS<br>Electrolytes<br>Acides & bases<br>Oxidation & reduction<br><br>EQUIVALENT & MOLECULAR WEIGHTS<br>Equivqlent weights<br>Determination<br>Molecular weights<br><br>NON METALS CHEMISTRY<br>Nitrogen & its compounds<br>Halogenes<br><br>ORGANIC CHEMISTRY<br>Functional groups<br>Element test<br>Proteins & carbohydrates | STRUCTURAL & FUNCTIONAL SYSTEM OF ORGANISMS<br>Animals<br>Plants<br><br>BIOACTIVITIES<br><br>OF ORGANISMS<br>Nutrition & digestion<br>Transport<br>Excretion<br>Support & skeleton<br>Locomotion & muscular system<br>Chemical control & nervous system<br>Reproduction<br><br>HEALTH & SICKNESS<br>Immunity &-Medication<br>Bacterial & viral diseases | HISTORICAL GEOLOGY<br>Fossils (animals & plants)<br>Stratigraphy (geological record)<br><br>ECONOMICAL<br><br>Minerals<br>Petroleum |

[a]Topics were obtained from the table of contents of Grade 12 Scientific Section Physics Textbook, 2nd ed. (Riyadh, Saudi Arabia: Ministry of Education, 1979).

[b]Topics were obtained from the table of contents of the Grade 12

Scientific Section Chemistry Textbook, 2nd ed. (Riyadh, Saudi Arabia: Ministry of Education, 1979).

[c]Topics were obtained from the table of contents of the Grade 12 Scientific Section Biology Textbook, 2nd ed. (Riyadh, Saudi Arabia: Ministry of Education, 1979).

[d]Topics were obtained from the official current curriculum of secondary stage, 2nd ed. (Riyadh, Saudi Arabia: Ministry of Education, 1974), pp.296-298.

Source: Al-Rashed A.A. (1983), An investigation of the general affective behavior toward science held by secondary school scientific section students at Riyadh City, Saudi Arabia. Unpublished doctoral dissertation, University of Northern Colorado, Greeley (p. 24).

Students have the option of selecting their courses in these schools, which differs from the traditional ones. According to Al-Hussain (1983), these schools "are being used as pilot schools with future evaluations planned" (p. 10).

The goals of secondary education set by the Educational Policy (as cited by Al-Zaid, 1982) are as follows:

1. Continuing the fulfillment of loyalty to God only, letting all deeds be performed to please Him, and seeing to it that they are straightforward from all aspects, according to His Laws.
2. Consolidating the Islamic faith by which a student can have a proper outlook on the universe, man, life on earth, and the hereafter. And providing him with basic notions and the Islamic culture, which can make him feel proud of Islam, capable of spreading the Message and of defending it.
3. Enabling him to be an active member of the Islamic Nation under the flag of oneness of God.
4. Fulfillment of loyalty to the Muslim Nation in general, and to his own nation (the Kingdom of Saudi Arabia), in particular, with a deep vision, an aspiration, for the highest social standing, and strong physical constitution, compatible with his age.
5. Taking care of capabilities of the student and his various inclinations, which begin to flower during this period, and directing such capabilities and inclinations in a manner suitable for him, in a way

which will realize the goals of Islamic education according to its general meaning.

6. Providing opportunities for capable students and preparing them to pursue their studies, at various levels, in higher institutes and university colleges of various specializations.
7. Preparing all students for work in the various fields of activity at proper levels.
8. The graduation of a number of vocationally and technically qualified persons to meet the needs of the country for the first stage of education and to perform religious duties, technical (agricultural, commercial and industrial) and other jobs.
9. Establishing family consciousness for the sake of founding sound Muslim families.
10. Preparing students to fight spiritually and physically for the sake of God.
11. Taking care of the youth according to Muslim principles, remedying their intellectual and sentimental problems, and helping them to pass this difficult period of their life successfully and safely.
12. Letting the students develop the good habit of useful reading and the desire to acquire further knowledge, perform good deeds, and utilize their leisure time in a beneficial manner that will enrich their personalities and uplift the conditions of their society.

13. Building of positive consciousness by means of which the student can face destructive ideas and misleading trends. (pp. 49-50)

One additional goal of secondary education with respect to science, as stated by the Educational Policy of Saudi Arabia (1974), is as follows:

> Developing scientific thinking in a student and deepening in him the spirit of research, experimentation, detailed systematic study, use of reference and habituation to sound study methods. (p. 12)

It seems that there is a lack of academic achievement among Saudi Arabian students. "There are spheres in which performance has not yet reached the levels expected to be attained in according with the Development Plan" (Al-Zaid, 1982, p. 90). For example, according to Ala-Jroush (1980 as cited by Al-Hussain) when an American team visited Saudi Arabia, the members of the team wrote: "The curriculum at all levels is devoted to verbal ability first, and writing ability second. Other skills are emphasized on a descending scale. Manipulation, preception motor, and kinesthetic skills are woefully under-emphasized. All subjects are considered separate. We saw no inter-disciplinary learning" (p. 10). Another important issue is that science curricula in Saudia Arabia has developed the cognitive domain, but not the affective domain, which motivates students toward their scientific culture and its effect on the development of the twentieth century. This has caused many students, especially Saudi students, to major in humanities rather than science. According to Al-Hussain (1983), "the humanities may have seemed easier and more appealing to most students" (p. 8). Al-Mazyed reported that the shortage of

Saudi students in the science sections might refer to some factors such as "the late arrival of imported laboratory science facilities and equipment. There were cases when the academic year came to an end before science laboratories were equipped" (p. 62). He recommended that "all secondary schools, regardless of size, should also be provided with educational media centers. Laboratories in small-sized secondary schools are in extreme need of science facilities, equipment, and supplies" (p. 225).

## Vocational Education

When students pass the intermediate examination, "students may choose from several options other than the public secondary schools. These options include the Vocational Institute, Agricultural Institute, the Commerce Institute, and the Teacher Education Institute" (Al-Hussain, 1983, p. 2). According to Filemban (1982), "students take academic classes supplemented with on-the-job training. It is possible for students to take course work in agriculture, engineering, electronics, architecture, and business" (p. 22).

## Higher Education

The first higher education in Saudi Arabia was established in Mecca in 1946, and later became Umm Al-Qura University in 1980. The modern higher education started with the establishment of King Saud University in 1975

(Ministry of Education, 1979). The rapid development of society has had its effect on the university growth, especially in the sixties (Karimi, 1983). This growth resulted in the establishment of the Ministry of Higher Education in 1975. According to Al-Rasheed (1983), "Higher education was supervised by the Ministry of Education until 1975, when the Ministry of Higher Education was established" (p. 17).

The Ministry of Higher Education is the official organization responsible for supervising and planning the higher institution in the Kingdom. There are seven universities in the country. They are as follows: King Saud University in Riyadh, established in 1957; King Abdulaziz University, which started as a private institution in 1967 and became a state university in 1971; Islamic University at Medina, established in 1961; The College of Petroleum and Minerals, which was raised to the university level in 1975; Umm Al-Qura University, Mekka, established in 1980; Imum Mohammed Bin Saud Islamic University, Riyadh, established in 1974, and; King Faisal University, Al-Ahsa, established in 1975. (Ministry of Education, 1979). Higher education is designed to develop an individual's abilities, to meet his needs as well as the needs of society, and to develop knowledge beneficial to his future. This level of education offers bachelor's degrees, with some universities also offering master's and doctoral degrees.

## Summary of the Development of Education in Saudi Arabia

Formal education in Saudi Arabia appeared in 1926. Prior to that time, there were some schools all over the Islamic world, especially in Mekka, where boys and girls were taught how to read and write Quran, Arabic language, and mathematics.

The Ministry of Education is the official organization responsible for boys' public education. Education is not compulsory and is free for both boys and girls. Public education consists of three stages, each of which has its own goals. Elementary education is the first stage. The period of study is six years, leading to the General Certificate of Elementary Education. Intermediate education is the second stage. The period of study is three years, leading to the General Certificate of Intermediate Education. After that stage, students may enroll in either vocational education or secondary education, which is the third stage of public education.

Students attend secondary education at the age of 15 for a period of three years, working towards the General Certificate of Secondary Education. Upon successful completion of the tenth grade, students may select either science or the humanities in the eleventh grade for their future studies. Students may enroll in postsecondary education after successful completion of secondary education. There are seven universities in the country. They are as follows: King Saud University, King Abdulaziz University, Islamic University at Medina, the College of Petroleum and Minerals, Umm Al Qura University, Imam Mohammed Bin Saud Islamic University, and King Faisal University. These universities offer bachelor's degrees in different fields. Some of them offer master's and doctoral degrees.

## Attitudes

The term "attitude" has many definitions and varies from one person to another. Gange and Brigges (1974) defined an attitude as "an internal state which reflects an individual's choice of action toward some object, person or event" (p. 62). Attitude is "a predisposition of the individual to evaluate some simple aspect of his world in a favorable or unfavorable manner" (Katzs, 1980, p. 168). Secord and Backman (1964) defined an attitude as "certain regularities of an individual's feeling, thought and predispositions to act towards some aspect of the environment" (p. 97). Rockeach (1968) defined an attitude as "relatively enduring organization of beliefs around an object or situation predisposing one to respond in some preferential manner" (p. 112). "Combining the common elements of several definitions, attitudes may be conceptualized as learned predispositions to respond positively or negatively to certain objects, situations, institutions, concepts, or persons" (Aiken, 1980, p. 2).

According to Munby (1983), attitude consists of three dimensions: cognitive, emotional, and behavioral cognitive.

"The cognitive dimension is derived from the idea that attitudes are evaluative; that is to make an evaluation, one must hold some knowledge of the subject or object, however minimal that knowledge might be. The emotional dimension incorporates the instant liking or disliking of an attitude object and the judgement one forms of the object, where judgements are seen as decisions made out of imperfect knowledge about the object. The behavioral or cognitive

dimension is to represent a person's predisposition to respond to an object in a certain way" (p. 70).

It should be noted that the term "attitude" should be distinguished from the following three concepts: (a) interests, (b) opinions, and (c) beliefs. Aiken (1980) distinguished among these three concepts as follows:

> The term interest is limited to a feeling or preference concerning one's own activities. Further, unlike an attitude, which implies approval or disapproval, a person who is interested in something thinks about and responds to it without making a moral judgement. The meaning of opinion is similar to that of attitude, but options are less generalized and more cognitive than attitudes. On the one hand, people are always completely aware of their opinions, while they may not be fully conscious of their attitudes. On the other hand, attitudes are considered to be more basic than opinions, in that attitudes combined with facts to produce an opinion are not necessarily additive. Attitudes serve, not only to organize facts into opinions according to some frame of reference, but they also affect the facts that will be selected for interpretations. (p. 2)

## Attitudes Measurement

Thurston Type Scale: According to Gardner, this scale consists of a number of opinion statements of which each statement has a scale value and the

scale value is the mean or the median of the ratings assigned to it by the judges. According to Selltiz, Wrightsman, and Cook (as cited by Aiken, 1980), this technique has some shortcomings. "The first objection is the great amount of work required by this procedure. The second objection is that the examinee's score may be obtained by different combinations of items. The third one is that the scale values may be influenced by the attitudes of the judges" (p. 5).

Rating scales do not appear to be widely used in research because "raters are not necessarily competent judges of the other people's attitudes. Second, even if self-rating is used, responses to a single item are not necessarily very reliable" (Gardner, 1975: p. 5).

Summated Ratings: "The most commonly used technique in research is the Likert type scale, which consists of a number of opinion statements, each reflecting either a favorable or unfavorable reaction to the attitude object being studied" (Gardner 1975: p. 5).

According to Issac and Michael (1981), "the main advantages of summated ratings are easy to develop and the greater variance obtained" (p. 142). The main disadvantages are as follows:

> The under-rater error -- rating subjects in general on the side of severity or unfavorableness.
>
> The central tendency error -- rating subjects toward the middle of the scale. This often occurs when the observer is unfamiliar with the uncertainty about what is being rated. (p. 86)

Semantic Differential Scales: According to Gardner (1975), "a word or phrase representing an attitude object is presented followed by several bipolar adjectives. These adjectives lie on the ends of a seven-point scale. One major advantage is that various attitude objects can be compared along standard dimensions" (p. 7).

Interests Inventories: According to Gardner (1975, p. 7), " these techniques typically contain a list of careers, topics, or activities, and the respondents indicate those in which they are interested" (p. 7).

Preference Ranking: These involve "comparisons between the student's enjoyment of science and his enjoyment of other subjects. One defect of this technique, is that although a student's attitude to science may change during a year, his ranking of science relative to other subjects may remain unaltered" (Gardner, 1975, p. 9).

Projective Techniques: According to Gardner (1975), these techniques contain a word association test and a sentence completion test.

Enrollment Data: "These are used to judge an individual's attitudes toward subjects, with the assumption that there is a strong relationship between interest and enrollment " (Gardner, 1975, p. 10).

Clinical and Anthropological Observations: According to Gardner (1975, p. 11), "this technique is used to determine children's attitudes toward science by observing their actions as they examine exhibits and photographs".

One of the most common problems in attitude research is how to develop a valid and reliable instrument. According to Gardner (1975):

> If a scale is to be valid and reliable, there should be preliminary attempt to specify as clearly the theoretical construct underlying the scale. If an instrument is to be constructed which is to measure different variables, each of these should be specified in advance; the instrument should yield separate variables. These two requirements are frequently ignored. (p. 12)

Aiken (1980) noted that there are some factors that could affect the reliability of the instruments. "Such variables include testing conditions, number of responses, categories, and scoring methods" (p. 10). In order to have good reliability, we have to control these factors. Shringley (1983) wrote:

> Science educators should investigate Ajzen and Fishbein's (1980) theory of reasoned action, especially their premise that writing statements that measure behavioral intention could do much to heal the troublesome attitude-behavior consistency problem. We should become as analytical in writing statements as we are in applying statistical analysis. We should start by scrutinizing every major word in a statement, especially nouns and adjectives, so that we can drop words that trigger attitudes other than the one under study. (p. 440)

In summary, the study of literature reveals that the term "attitude" has different meanings. However, attitude can be inferred from behavior (Gangne´,1976). "Attitudes may be conceptualized as learned predisposition to respond positively or negatively to certain objects, situations, institutions,

concepts or persons" (Aiken, 1980, p. 2). Attitudes should be distinguished from interests, opinions, and beliefs. Finally, attitudes are measured by different scales according to the behavior being measured.

## Scientific Attitudes

The science education community considers attitudinal objectives important. It is most useful, however, to distinguish between two broad subjects of science-related attitudes. The first is scientific attitudes (Schibeci, 1983, p. 597). Gauld (1982) described scientific attitudes as:

> The adoption of a particular approach to solving problems, to assessing ideas and information or to making decisions. Using this approach, evidence is collected and evaluated objectively so that the idiosyncratic prejudices of the ones making judgement are not included. No source of relevant information is rejected before it is fully evaluated and all available evidence is carefully weighed before the decision is made. If the evidence is considered to be insufficient, then judgement is suspended until there is enough information to enable a decision to be made. No idea, conclusion, decision or solution is accepted just because a particular person makes a claim, but it is treated skeptically and critically until its soundness can be judged according to the weight of evidence which is relevant to it. A person who is willing to follow such

> procedures and who regularly does so, is said by science educators to be motivated by scientific attitudes. (p. 440)

The importance of scientific attitudes led many writers to focus on their development and on how these attitudes should be developed. Gauld (1982, p. 2) suggested two methods for teaching scientific attitudes. The first is to have the student practice the role of the scientist in order to learn about the nature of scientific activity. The second is to teach that scientific attitudes represent desirable personal attributes for all people. Gauld argued that:

> The development of scientific attitude should be eliminated as one of the major goals of science education. This certainly follows the attitude as it has been formulated by science educators for the last 60 years. Teaching that scientists possess these characteristics is bad enough, but it is abhorrent that science educators should actually attempt to mold children in the same image. On the other hand, very few writers explain what they mean by openmindedness, objectivity, and skepticism, and little indication is given to how one decides when there is sufficient evidence to make a decision. It is possible that if such terms were clarified, and that the way in which they relate to scientific practice were discussed more carefully in the light of the material presented here, one could retain a reformulated and more acceptable version of the scientific attitude. If many conceptions of the scientific attitude are to be retained in science education, it is no longer sufficient to

build unquestioningly on the consensus of science educators. (Gauld, 1982, pp. 118-119)

Gauld and Hukins (1980) mentioned that the components of scientific attitudes are as follows:

Group 1: General attitude toward ideas and information, such as curiosity, open-mindedness, skepticism, humility, anti-authoritarianism and creativity.

Group 2: Attitudes related to the evaluation of ideas and information. This can generally be labeled as critical-mindedness and contains such things as (a) objectivity showing lack of personal bias, with a high regard for (scientific) criteria such as accurate empirical data, controlled experimentation, logic, and reason; (b) intellectual honesty; and (c) a tendency to exercise caution when drawing conclusions or making decisions (including a willingness to weigh all available evidence and to change one's mind or suspend judgement depending on the results).

Group 3: Commitment to particular (scientific) beliefs, such as loyalty to truth, belief in the understandability of nature, the existence of natural cause and effect in relationships, and lack of foundation for superstition. (p. 133)

Diedrich described the components of scientific attitude as follows:

Skepticism. Not taking things for granted,

Faith in possibility of solving problems,

Desire for experimental verification,

Precision,

A liking for new things,

Willingness to change opinion,

Humility,

Loyalty to truth,

An objective attitude, aversion to superstition,

Liking for scientific explanations,

Desire for completeness of knowledge, suspended judgement,

Distinguishing between hypotheses and solutions,

Awareness of assumptions,

Judgement of what is fundamental and of general significance,

Respect for theoretical structures,

Respect for quantification,

Acceptance of possibilities,

Acceptance of warranted generalizations. (pp. 23-24)

In order to foster scientific attitudes in any educational community, Schibeci (1983) reminded curriculum writers, and others who influence education, of the danger in assuming that attitudinal objectives may be treated in the same way as cognitive objectives. Haney (1983) suggested the following for

fostering scientific attitudes:

> (a) In order to foster "curiosity," the teacher should ask himself how to teach. Teachers should offer problematic solutions where answers are not immediately available. (b) To develop the attitude of rationality, the public can be confronted with situations in which careful reasoning proves superior to explanations of superstitious nature. (c) To learn the attitude of suspended judgement, science teachers ought to examine closely the common practice of asking students to formulate a conclusion at the end of every five-minute demonstration or forty-minute experiment. (d) To foster the attitude of open-mindedness, teachers should provide evidence to support the generalization in the lessons. Pupils should be taught to provide these in their community. (e) To learn the attitude of objectivity, students may be confronted by situations in which the temptations to permit personal feelings to interfere with the recording of an observation or the interpretation of data must be successfully resisted in order to achieve a correct or accurate solution to problems. (f) To learn the attitude of honesty, teachers must ask themselves how they reward honesty in their classrooms. In the laboratory, for instance, do the pupils know the right answers to report, regardless of their actual sense of data. (pp. 33-34)

Klausmeier (1986, p. 267) suggested the following to facilitate the learning of scientific attitudes:

1. The attitude to be learned must be identified.
2. The meaning of the vocabulary must be classified for the learner.
3. Informative experience about the attitude "object" should be provided. In the case of scientific attitudes, these "objects" are usually the various situations that occur in the problem-solving process. The following are typical:
    a. The sensing of problems in a perplexing situation;
    b. Clarifying and defining the problem;
    c. Formulating the hypothesis;
    d. Reasoning out the consequences of the hypothesis and the designing of investigation;
    e. Gathering of data;
    f. Treating and interpreting of data;
    g. Generalizing or drawing conclusions; and
    h. Communicating the results of investigations of others.
4. Desirable identifying figures for the learner should be provided.
5. Pleasant emotional experience should accompany the learning of the attitude.
6. Appropriate context for practice and conformation should be arranged.
7. Group techniques should be used to facilitate understanding and acceptance.

8. Deliberate cultivation of the desired attitude should be encouraged.

Gauld and Hukins (1982) made some recommendations for changes in research into scientific attitudes. They are (a) "improvement in communications, (b) increase in conceptual clarity, (c) engagement in sustained research programs, and (d) employment of innovative techniques" (pp. 152-153).

In summary, the literature reveals that scientific attitudes are "the adoption of a particular approach to solving problems, to assessing ideas and information, or to make decisions" (Gauld, 1982, p. 110). "Scientific attitudes" have a predominantly cognitive orientation (Gardner, 1975). Strategies for their improvement were discussed. Teachers and researchers should be aware of these strategies in order to avoid weaknesses that could occur in future research.

## Attitudes Toward Science

The goal of any educational community is to foster positive attitudes of students, especially in the field of science, in order to achieve criteria set by the community for a better life, either in the present or in the future. Attitude research is one of the most difficult ones in the educational setting because of the definition (Haladyna and Shaughnessy, 1982; Schibeci, 1984) and the shortcomings of the instrumentation (Hunky, 1983). Haladyna, Olson and Shaughnessy (1982, p. 671) listed the following problems included in attitude research:

1. a theoretical content,

2. verifying definitions of attitudes,
3. lack of integrative research,
4. haphazard selection of variables,
5. lack of valid instruments, and
6. poorly conceived, designed and analyzed experiments.

One of the major problems in assessing attitudes results from "poor psychometric qualities of many instruments used to assess attitudes" (Schibeci, 1983, p. 599) and their lack of validity (Cavin and Lagowski, 1981). The term "attitude toward science" has no specific meaning (Krynowsky, 1985). This confusion leads many writers to define it in a variety of ways.

Attitude toward science "reflects the individual's opinions and dispositional reactions to scientific enterprise: its significance and utility to individuals and societies; the comprehensibility, validity and reliability of its claim in both knowledge and methodology" (Hassan, 1985, p. 4). Dutton and Stephens (1983, p. 43) defined these attitudes as "how an individual feels about science." The majority of studies on attitudes toward science have been concerned with affect or feeling--like versus dislike--toward science in general, or particular science (Aiken and Aiken, 1969, p. 295). "The term 'attitude' should be used to refer to a general and enduring positive or negative feeling about science" (Koballa and Crawley, 1985, p. 230).

Novick and Duvdvani (1976) concluded that Israeli tenth grade students held more emotional attitudes than those on the intellectual scales. Haladyna and Shaughnessy (1982) concluded that students have positive

attitudes toward science. Wilson (1981) explained that students have positive attitudes toward science following participation in the Discovery Hall Project Summer Program. Mason (1986) discovered that an experimental group had higher mean scores on attitudes than the control group. Renner and others (1985) noted that students preferred laboratory work which would help them to remember, and be less confused. Souza (1984) found that students who participated in marine science had more positive attitudes than those who did not participate. Al-Rasheed (1983) found that there was (a) a positive affect behavior toward science among secondary school scientific section students in Riyadh; (b) there was no significant difference in general affective behavior toward science among male and female secondary school scientific section students; and (c) there was no significant difference in general affective behavior among grades 10, 11, and 12 scientific section students.

Squires (1983) concluded that high school seniors enrolled in a sequence of science courses had more positive attitudes toward science and scientists then did those not enrolled. Villasmil (1985) stated that students had positive attitudes toward energy-related matter.

> The assumption that students will acquire positive attitudes toward science as they learn more science facts is no longer valid. Planning is required to ensure the development of positive attitudes toward science. Failure to plan and teach the development of positive attitudes toward science may well result in

science curriculum that fails to prepare students to make judicious decisions about science and their future needs dictate. (Koballa and Crawley, 1985, p. 222)

Student attitudes toward science are directly related to teachers (Krynowsky, 1985). In order to improve teacher's attitudes toward science that would then help students develop positive attitudes, Koballa and Rice (1985) suggested the following strategies:

1. Project an image of credibility.
2. Take advantage of social and environmental influences.
3. Identify student's unique needs.
4. Be aware of attitudes and skills of the students' parents.
5. Use discrepant events to teach science.
6. Involve students in science rather than simply talking about it. (pp. 32-34)

Haladyna, Olsen and Shaughnessy (1982) suggested the following for improving science attitude research:

1. Include a description of the sample, including the number of boys and girls and grade levels studied;
2. Include a description of instrumentation, including reliability estimates and evidence of validity;
3. Include multivariate procedures where appropriate in the method of analysis; and
4. Present data in a format that communicates the essence of the

findings, as well as the magnitudes of the effects.

In summary, the literature revealed that "attitudes toward science" refers to whether an individual reacts favorably or unfavorably toward an object, person, and so on. Attitudes toward science "refers to how an individual feels about science" (Dutton and Stephens, 1983, p. 43). The term "attitude" should be used to refer to a general and enduring positive or negative feeling about science (Koballa and Crawley, 1985, p. 230). The literature reveals that students have positive attitudes toward science. Problems included in attitude research were also discussed. Planning and teaching are both required for the development of positive attitudes toward science in the school setting.

## Science Achievement and Attitudes Toward Science

Many studies have focused on the relationship between students' attitudes and science achievement including those by Alvord, 1972; Tamir, 1986; Grawley, 1985; Haun, 1958; Myers, 1967; Staver, 1986; Tunhikorn, 1986; Hamilton, 1982; and; Haladyna and Shaughnessy, 1982. Science achievement is defined as the retention and understanding of scientific skills and knowledge (Joyce and Weill, 1972). Achievement is defined as an accomplishment of proficiency of performance in a given skill or body of knowledge (Good, 1973).

Myers (1967) found no relationship between college students' attitudes

toward science and their high school backgrounds in science. Staver (1986) concluded that students' achievement in private school did differ from the achievement of students in public schools. Tamir (1986), compared achievement of Jewish biology majors with that of Arab biology majors. He found that girls of both nationalities achieved generally as well as boys and that Jewish boys and girls achieved better in cognitive areas. He also found that multiple choice items were more difficult for Arab students. He concluded that the gap between achievement levels of Jewish and Arab students appeared to be closing, especially in those tasks that require lower cognitive abilities or simple process laboratory skills.

Crawley (1985) noted that there was a significant difference between the cognitive and affective characteristics of students with differing need levels; students differed in their attitudes toward science; and matching was not valid for students who had low-level needs. Differences in achievement (not attitudes) were found to be dependent upon the extent of matching. Haun (1958) found that the majority of the students agreed that science is interesting and has value even for nontechnical vocations.

Tunhikorn (1986) found that, generally, girls had better attitudes toward science than boys as grade level increased. At all grade levels, boys performed better than girls in physical science, and girls performed better than boys in biological science. Friend (1984) studied the effect of science and mathematics integration on student's attitudes toward science and achievement in science. His findings showed that (a) students with standardized reading and

mathematics scores two years above grade level, using the integrated format, achieved better than those students using the nonintegrated format; (b) there is no significant difference in attitudes toward science between students using the integrated and the nonintegrated format; and (c) students with standardized reading and mathematics scored at their grade level, using the integrated format. Simpson and Oliver (1985) found a negative relationship between attitudes toward science and achievement motivation among males and females in grades six through ten. Males held more positive attitudes toward science than females. Cannon and Simpson (1985) found a weak relationship in attitudes toward science and achievement motivation. Abunejemeh (1985) found no significant difference between students' attitudes toward science and their grade point average in science courses. Wilson (1983) used Ameta analysis to determine the relationship between science achievement and attitudes toward science, of kindergarten through college students. He found a consistent low correlation between attitudes toward science and science achievement. Hamilton (1982) found a relationship between attitudes toward science and science achievement. Raghubir (1979) reported that the laboratory investigative approach was a successful teaching tool for attitude development. Mallon and Bruce (1982) found a relationship between student achievement and attitudes in astronomy.

Only a few studies of Saudi education have focused on the relationship between attitudes toward science and science achievement. These include the works of Harty and Al-Faleh (1983), Al-Hemaisan (1985) and Al-Rashed (1984). Harty and Al-Faleh (1983) studied chemistry achievement and attitudes toward

science of eleventh grade Saudi Arabian students who were assigned to two treatment groups. These findings showed that those in the small laboratory group achieved higher scores than those in the lecture group. Al-Hemaisan (1985) found no differences in attitudes toward science between gifted and nongifted students. However, for the gifted students, there was a significant correlation between science achievement and attitudes toward science. Al-Rashed (1984) concluded that (a) use of specific questions resulted in higher student achievement, and (b) different combinations of teacher behavior had greater influence on achievement than on attitudes of students. Student achievement was also influenced by variations in wait-time and question levels. Both achievement and attitudes were influenced by use of broad questions and extended wait-time.

## Summary of the Literature Review on Relationships Between Science Achievement and Attitude Toward Science

Some of the previous studies (Oliver, 1985; Simpson, 1985; Abunejemeh, 1985; and Wilson, 1983) in this literature survey revealed that attitudes toward science are not directly associated with science achievement. According to Alvord (as cited by Hough and Piper, 1982) "the relationship between attitudes toward science and science achievement varies according to certain individual pupil characteristics such as sex, race and grade level" (p. 33). However, other studies by (Meyers, 1967; Friend, 1984; and Hamilton, 1982) have reported a strong relationship between attitudes toward science and science achievement.

This implies that students with positive attitudes toward science achieve better grades in science courses than those students with poor or negative attitudes toward science.

# CHAPTER III

# METHODOLOGY

The purpose of this chapter is to provide a description of the methodology used in this study. It contains the following: (a) sample size, (b) dependent variables, (c) instruments and their administration, and (d) statistical methods for analyzing the data.

## The Sample Size

The sample size for this study was 334 male students who were taking physical science coueses; 166 Saudi and 168 non-Saudi Arabic students, at different secondary schools in Riyadh. They were selected from a total population of 2252 students attending grades 10, 11, and 12. There were 115 students, consisting of 57 Saudi and 58 non-Saudi, in grade 10; 109 students, consisting of 54 Saudi and 55 non-Saudi in grade 11; and 110 students, consisting of 55 Saudi and 55 non-Saudi in grade 12. The distribution of the student population is shown in Table 4. These students were chosen at random from eight secondary schools by using the facilities of the Public Statistical Bureau.

Table 4

Student Population

| | Nation | | |
|---|---|---|---|
| Grade | Saudi | Non-Saudi | Total |
| 10 | 57 | 58 | 115 |
| 11 | 54 | 55 | 109 |
| 12 | 55 | 55 | 110 |
| Total | 116 | 168 | 334 |

According to Cohen (1969), when Y = .25 and power level 1 - B = .80, and significance level is set at .05, then the minimum number of subjects per cell should equal 52. Each cell exceeded the minimum sample size. (Tunhikorn, 1986)

## Research Variables

The variables for this study were attitudes toward science and achievement in chemistry and physics. Attitude toward science instrument was measured by administering the attitude toward science as a pretest at the beginning of the first term 1986, and a posttest at the end of the same term. Achievement in chemistry and physics was measured by administering six tests,

three tests in chemistry and three tests in physics for each grade level.

## The Instruments

To develop the instrument to measure attitude toward science, an initial item pool of 82 statements was generated and modified from the following sources:

1. Haladyna and Shaughnessy: unpublished manual (1982).
2. The WASP: Wareing Attitude Toward Science Protocol (Wareing, 1982). Permission was obtained to use these instruments (see Appendixes A and B).

A panel of 25 experts in the field of Saudi and non-Saudi science education determined content validity utilizing the Delphi technique. They were from the following institutions: (a) College of Education, (b) Center of Educational Development, and (c) Secondary Schools, Riyadh. Each judge rated each item from 1 to 11 where item scores represented equal interval data (Aiken, 1980). These statements varied from least favorable (1), to the most favorable (11). Category 1 represented the highest negativity, while category 11 represented the highest positivity. Categories from 7-11 represented positive numbers, while category 6 represented the neutral point. After all the judges completed the rating process for all of the statements, the median score and semi-interquantile were calculated for each item according to the following formulas:

$$Md = X_{LL} + \frac{(N/2 - fb)i}{fw}$$

where:

Md = the median,
$X_{LL}$ = lower limit,
N = number of judges,
fb = frequency below the interval,
fw = frequency within the interval, and
i = class interval.

Semi-interquartile was calculated as follows:

$$SIQR = \frac{Q_3 - Q_1}{2}$$

$Q_3$ represented 75% of the distribution, and
$Q_1$ represented 25% of the distribution.

The statements that received high semi-interquartile scores were eliminated from the attitude inventory. Of 82 statements, the final attitude scale consisted of 39 items. These items were given to experts in the field of Arabic Language at the Center of Educational Development to check the precision of the translation of the instruments into the Arabic language. A five-point Likert Scale was used ranging from "strongly agree" to "strongly disagree". These were "strongly agree" (5), "agree" (4), "uncertain" (3), "disagree" (2), and "strongly disagree" (1).

## The Pilot Study

During October, 1986, a pilot study was conducted, using the first draft of the attitude inventory. The target group consisted of 90 Saudi and non-Saudi students in grades 10, 11, and 12. There were 45 Saudi and 45 non-Saudi Arabic students. Permission was sought from the Directorate of Regional District of Riyadh to use these students. These students were chosen randomly. The administration time of the instrument was 20 minutes. From the field test, the reliability established by Cronbach coefficient was found to be .79. Items that showed correlation below .30 were eliminated from the instrument. Thirteen items were selected to be included in the final version of the attitude inventory (see Appendix C).

## The Reliability

An estimate of the internal consistency of the Likert scores assigned by the sample in this study was determined by using the method described by Hoyt and Stunkard (1952). This method provides a straightforward solution to the problem of estimating the reliability coefficient for unrestricted scoring items (Courtney, 1983). The following procedure was used for calculating the reliability coefficient by the Hoyt and Stunkard Method. Let $x_{ij}$ represent the score obtained by the ith individual from the jth item; where i = 1, 2,

3 . . . k, and j = 1, 2, 3 . . . n. The various summations of the $X_{ij}$ gives: $xj = {}_i x_{ij}$ the score for the jth item for all individuals; and $x \ldots = {}_i x_j x_{ij} = {}_i x_i = x_j$ the sum of the scores of all individuals over all items. The matrix is shown below.

| Component (items) | Subject (respondents) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | . | . | j | . | . | n | Total |
| 1 | $X_{11}$ | $X_{12}$ | $X_{13}$ | | | $X_{ij}$ | | $X_1$ | n | $X_{1.}$ |
| 2 | $X_{21}$ | $X_{22}$ | $X_{23}$ | | | $X_{2j}$ | | $X_2$ | n | $X_{2.}$ |
| . | | | | | | | | | | |
| . | | | | | | | | | | |
| i | $X_{i1}$ | $X_{i2}$ | $X_{i3}$ | | | $X_{ij}$ | | $X_i$ | n | $X_{i.}$ |
| . | | | | | | | | | | |
| . | | | | | | | | | | |
| K | $X_{k1}$ | $X_{k2}$ | $X_{k3}$ | | | $X_{kj}$ | | $X_k$ | n | $X_{k.}$ |
| Total | $X_{.1}$ | $X_{.2}$ | $X_{.3}$ | | | $X_{.j}$ | | $X_.$ | n | $X_{..}$ |

The sum of squares for individuals is obtained by:

$$A = \frac{\Sigma_i X^2_{i.}}{n} - \frac{X^2_.}{Kn};$$

The sum of squares for items is computed by:

$$B = \frac{\Sigma_j X^2 \cdot j}{k} - \frac{X^2}{Kn}$$

The total sum of squares is obtained by: $T = \Sigma j' jX2ij - \frac{X^2_{..}}{kn}$

The residual sum of squares is obtained by subtraction:

$$C = T - A - B$$

The analysis of variance may be written in part as suggested by Hoyt and Stunkard (1952) in Table 5.

Table 5

Analysis of Variance

| Source | df | sum squares | mean square |
|---|---|---|---|
| Among individuals ---------- | K-1 | A1 | A' |
| Among items ---------- | n-1 | B | B' |
| Residual ---------- | (k-1)(n-1) | C | C' |
| Total | Kn-1 | T | T' |

Calculation of the "mean squares" by dividing the "sums of the squares" by their respective number of freedom provided the estimate of the reliability as follows:

$$Rtt = \frac{A' - C'}{A}$$

<u>The Science Achievement Tests</u>

Science achievement tests in chemistry and physics for grade 12 were designed by experts in the field of science in Riyadh Educational Directorate.

These tests were revised before the administration of the instrument. The content validity was verified by a Delphi panel. These tests represented the curricula goals of science achievement in secondary schools.

Science achievement tests in chemistry and physics for grades 10 and 11 were designed by classroom science teachers. There was no effort to calculate their validity and reliability, but the content was verified through content validation by the Delphi technique in order to meet the goals of science achievement in secondary schools (Al-Hemaisan, 1985).

Administration of the Attitude Toward Science Instrument

On October 28, 1986 the attitude toward science instrument was administered as a pretest to the students in grades 10, 11, and 12 at eight secondary schools in Riyadh at the beginning of the first term of 1986. The tests were administered to all students on the same day by the teachers. Prior instructions were provided to the teachers to avoid any extraneous variables that could jeopardize the reliability of the instrument. The administration time of the instrument was 20 minutes. At the end of the first term of 1986, the instrument was administered again as a posttest to the same sample (334) students in grades 10, 11, and 12. The same instructions were given to the teachers for administering the tests.

## Administration of the Science Achievement Tests

The science achievement tests for grades 10, 11, and 12 were administered to the students by their teachers during the classroom period, at the end of the first term of 1986. The data were obtained through the school principals.

# Data Analysis

The purpose of the study was to compare Saudi and non-Saudi Arabic students' attitudes toward science and science achievement in chemistry and physics in Saudi secondary schools in the city of Riyadh. The following procedures were used to analyze data in testing hypotheses: (1) Two-way analysis of covariance was used to determine differences in attitudes toward science between Saudi and non-Saudi students in grades 10, 11, and 12. (2) Multivariate analysis was used to determine differences in chemistry and physics, and (3) Pearson product- moment correlation was used to determine the relationship between attitudes toward science and achievement.

## Statistical Analysis for Attitude Toward Science

The statistical hypotheses to determine the differences in attitudes toward science between Saudi and non-Saudi Arabic students were tested using

two-way analysis of covariance. The null hypotheses were as follows:

1. There is no significant nationality level effect

$$\sigma^2_N = 0$$

2. There is no significant grade level effect

$$\sigma^2_G = 0$$

3. There is no significant interaction effect

$$\sigma^2_{NXG} = 0$$

The mathematical model for testing these hypotheses was:

$$Y_{ijk} = \mu + \tau_i + \gamma_j + \beta(X_{ijk} - \bar{x}) + \epsilon_{ijk}$$

where $\tau_i$ is the first factor effect, $\gamma_j$ is the second factor effect, $\beta(X_{ijk} - \bar{x})$ is the adjustment of the postmeasure, and $\epsilon_{ijk}$ is a residual variable. The two-way analysis of covariance layout as suggested by Tuhinkorn (1986, p. 55) is shown on Table 6.

Table 6

Two Way Analysis of Covariance

| Source of Variation | df | ss | Ms | computed F |
|---|---|---|---|---|
| Nationality | K-1 | A | A/K-1 | MS/MSE |
| Grade | r-1 | B | B/r-1 | MS/MSE |
| Interaction | (c-1)(r-1) | C | c/(c-1)(r-1) | Ms/MSE |
| Error | n-rk | D | D/n-rk | |
| Total | n-2 | E | | |

Statistical Analysis for Science Achievement in Chemistry and Physics

To determine the differences in physics and chemistry achievement among Saudi and non-Saudi students attending grades 10, 11, and 12 in secondary schools in Riyadh, students were tested using a multivariate analysis of covariance.

The null hypotheses for determining the differences in physics and chemistry achievement between Saudi and non-Saudi students in grades 10, 11, and 12 were as follows:

1. There is no significant difference between Saudi and non-Saudi students with respect to posttest Attitude and chemistry and physics achievement.
2. There is no significant difference among grades 10, 11, and 12 with respect to posttest attitudes, chemistry and physics achievement.
3. There is no significant interaction between grade level and nationality with respect to posttest attitude and chemistry and physics achievement.
4. There is no significant relationship between the covariate prettest attitude, posttest attitude, and chemistry and physics achievement.

# CHAPTER IV

## ANALYSIS AND INTERPRETATION OF THE FINDINGS

The purpose of this study was to (a) develop an attitude toward science instrument, (b) to determine differences in science and science achievement in chemistry and physics, and (c) to examine the possible relationship between attitudes and science achievement among Saudi students in grades 10, 11, and 12. In other words, the problem being investigated was as follows: (a) to develop a valid and reliable attitude toward science instrument for use with Arabic students at the secondary level, (b) to determine differences in attitudes toward science and achievement in physics and chemistry in grades 10, 11, and 12 between Saudi and non-Saudi Arabic students in secondary schools in Riyadh, Saudi Arabia, and (c) to determine the relationship between measures of students' attitude toward science and achievement in physics and chemistry in grades 10, 11, and 12.

This chapter contains an analysis of science achievement and attitude toward science measures. The first three hypotheses, as stated earlier in chapter III, determined the differences between Saudi and non-Saudi as follows:

1. There is no significant nationality effect.
2. There is no significant grade level effect.
3. There is no significant interaction effect.

Attitudes toward science was determined by administering the attitude

toward science instrument to 334 Saudi and non-Saudi Arabic male students. Science achievement in chemistry and physics were determined by administering six tests, three tests in chemistry and three tests in physics for each grade level.

## Attitude Toward Science

The attitude toward science instrument was administered to 334 students at eight secondary schools in Riyadh, Saudi Arabia at the beginning of the first term of 1986. At the end of the term the instrument was administered again to the same students in grades 10, 11, and 12. There were 115 students, consisting of 57 Saudi and 48 non-Saudi, in grade 10; 109 students, consisting of 54 Saudi and 55 non-Saudi, in grade 11; and 110 students, consisting of 55 Saudi and 55 non-Saudi in grade 12.

### Validity and Reliability of the Attitude Toward Science Instrument

The Delphi Technique was utilized to determine content validity. A panel of 25 experts in the field of Saudi and non-Saudi science education rated each item from 1 to 11 by the method of equal appearing interval, where each statement represented a negative or positive attitude toward science.

An estimate of the internal consistency of the Likert scores assigned by the sample in this study was determined using the method described by Hoyt and

Stunkard (1952). Utilizing this technique, the reliability of the pretest was found to be .66. The reliability of the posttest was .61 as shown in Table 7.

Table 7

The Reliability Coefficient of the
Attitude Toward Science Instrument
(Posttest)

| Source of Variation | df | Sum of Squares | Mean Squares |
|---|---|---|---|
| Among individuals | 333 | 765.264 | 2.305 |
| Among items | 12 | 5040.555 | 420.046 |
| Residual | 3996 | 3556.676 | .892 |
| Total | 4341 | 9362.495 | |

The reliability coefficient is calculated as follows:

$$r = \frac{A' - C'}{A'} = \frac{2.30501 - .89274}{2.30501} = .6127$$

Discussion of the Reliability Coefficient

The reliabilities of the attitude toward science instrument for pretest and posttest were .668 and .6127, respectively. It seems that these findings were moderate. The drop to .6127 in the posttest, is possibly attributable to poor instructions by the teachers, shortcomings of the instrument, or some factors

associated with schools. From the research point of view, these reliability coefficients are adequate for justification that the attitude toward science instrument was reliable for use with Saudi and non-Saudi Arabic male students at the secondary level (grades 10, 11, and 12).

Differences in Attitudes Toward Science

Table 8 presents the means and the standard deviations of all students in grades 10, 11, and 12.

Table 8

Means and Standard Deviation
of Attitude Toward Science score
Pretest by Grade Level

| Grade | Mean Score | Standard Deviation |
|---|---|---|
| 10 | 2.88 | .44 |
| 11 | 2.93 | .47 |
| 12 | 2.52 | .27 |

From Table 8, the means and the standard deviations of attitudes toward science of all students in grades 10, 11, and 12 ranged from 2.5 to 2.9, and from .27 to .47.

Table 9 reports the means and the standard deviations of the attitude toward science by grade level "posttest".

Table 9

Means and Standard Deviation of
Attitude Toward Science by
Grade Level "Posttest"

| Grade | Mean Score | Standard Deviations |
|---|---|---|
| 10 | 2.81 | .41 |
| 11 | 2.80 | .40 |
| 12 | 2.81 | .40 |

From Table 9, the means and the standard deviations of attitudes toward science for all students ranged from 2.8006 to 2.80705 and from .3974 to .4088.

The means and the standard deviation of the attitude toward science measures for all students in grades 10, 11, and 12 are reported in Table 10.

Table 10

Means and Standard Deviation of the Attitude Toward Science Instrument "Prepost" by Nationality

| | Nation | Mean | Standard Deviation |
|---|---|---|---|
| Pre | Saudi | 2.7493 | .4781 |
| | Non-Saudi | 2.8086 | .4512 |
| Post | Saudi | 2.9305 | .3934 |
| | Non-Saudi | 2.6795 | .4112 |

From Table 10, the means of the attitudes toward science for Saudi students, "prepost" were 2.7493 and 2.9305 respectively. The means of attitudes toward science for non-Saudi "prepost" were 2.8086 and 2.6795 respectively.

The means and the standard deviation of attitudes toward science of all students in grades 10, 11, and 12 are reported in Table 11.

Table 11

Means and Standard Deviations of Attitude Toward Science "Prepost" by Nationality and Grade Level

| | | Mean | Standard Deviation |
|---|---|---|---|
| | Saudi | | |
| | 10th | 2.973 | .4357 |
| | 11th | 2.9487 | .4559 |
| | 12th | 2.3217 | .1366 |
| PRE | | | |
| | Non-Saudi | | |
| | 10th | 2.7944 | .4379 |
| | 11th | 2.9203 | .4910 |
| | 12th | 2.7119 | .4047 |
| | Saudi | | |
| | 10th | 2.9231 | .4115 |
| | 11th | 2.9131 | .3657 |
| | 12th | 2.9552 | .4067 |
| POST | | | |
| | Non-Saudi | | |
| | 10th | 2.6910 | .4061 |
| | 11th | 2.6881 | .4442 |
| | 12th | 2.6587 | .3882 |

The null hypotheses of the attitude toward science measures as stated in chapter III were as follows:

1. There is no nationality effect.

2. There is no grade level effect.

3. There is no interaction effect.

To test these hypotheses, a two-way analysis of covariance was performed.

The two-way analysis of covariance layout for this study is shown in Table 12.

Table 12
Two-Way Analysis of Covariance

| Source of Variation | DF | SS | MS | F | p value |
|---|---|---|---|---|---|
| Covariate | 1 | .0398 | .0398 | .2429 | .622 |
| Grade | 2 | .0037 | .0075 | .0459 | .955 |
| Nationality | 1 | 5.2741 | .2741 | 32.145 | .000* |
| Grade x Nationality | 2 | .0283 | .0565 | .3448 | .709 |
| Error | 327 | | | | |
| Total | 333 | | | | |

* Significant at .05 level.

The covariate "pretest" measures were not significant with a p value of .622 which is larger than the level of significance ($\alpha$ = .05). This finging does not help us in explaining differences between nationalities or differences among grades.

1. Looking at nationality in Table 12 reports that there was significant difference between Saudi and non-Saudi students where p-value <.05. The null hypothesis was rejected. Table 10 shows that the mean of Saudi students (post) was 2.93, while the mean of non-Saudi was 2.67.

2. The analysis for the grade level in Table 12, showed no significant difference.

3. The interaction test for grade and nationality in Table 12, indicated no statistical interaction. Since p value of .709 is larger than the stated alpha level

for hypothesis testing significance ( $\alpha$ = .05), the null hypothesis was retained.

## Science Achievement

Science achievement scores in chemistry and physics were analyzed using multivariate analysis of covariance. The null hypotheses to determine difference in achievement were as follows:

1. There is no significant difference between Saudi and non-Saudi Arabic students in chemistry achievement.
2. There is significant difference between Saudi and non-Saudi Arabic students in physics achievement.
3. There is no interaction between grade level and nationality with respect to posttest attitude and achievement in chemistry and physics.
4. There is no significant relationship between the covariate pretest, posttest, and achievement in chemistry and physics.

Table 13 shows the results of the multivariate analysis of covariance.

Table 13

Multivariate of Significance
(Wilkes Lambda)

| Effect | p Value |
|---|---|
| Nationality | .0.000* |
| Grade | .183 |
| Nationality & Grade | .258 |
| Covariate "Pre-Attitude" | .557 |

*Significant at .05

With the exception of the nationality effect, all tests showed that the null hypothesis was retained. The nationality effect was found to be highly significant at the .05 level. Table 14 reports the results of testing for each of the dependent variables.

Table 14
Univariate F Tests for Nationality Factor

| Dependent Variable | p Value |
|---|---|
| Attitude (Post) | .000* |
| Chemistry | .063 |
| Physics | .232 |

*Significant at .05

Table 14 reports that the nationality effect was highly significant when looking at attitude (post), chemistry and physics. A univariate Anova was conducted on each of the dependent variables. Clearly for posttest attitudes, there was a difference between nationalities, as mentioned earlier.

Chemistry Ancova p value of .063 was not statistically significant. However, from what is known about these students and a borderline p value, this suggests that there is small differences at the .063 level.

Table 15 reports the means and the standard deviations in chemistry for Saudi and non-Saudi Arabic male students (grades 10, 11 and 12).

Table 15

Means and Standard Deviations in Chemistry for Saudi and Non-Saudi (grades 10, 11, 12)

| | | Mean | Standard Deviation |
|---|---|---|---|
| Nation | Saudi | | |
| Grade | 10 | 27.2456 | 8.6469 |
| Grade | 11 | 30.8241 | 8.0025 |
| Grade | 12 | 30.4636 | 10.8217 |
| Nation | Non-Saudi | | |
| Grade | 10 | 31.4405 | 10.7842 |
| Grade | 11 | 31.9828 | 7.5943 |
| Grade | 12 | 31.1636 | 10.5865 |

The best estimate of differences between Saudi and non-Saudi students was to compare average grades as follows. The results of this analysis is found in Table 16.

Table 16

Grade Average in Chemistry
Between Saudi & Non-Saudi (grades 10, 11, 12)

| Nation | Mean | Standard Deviation |
|---|---|---|
| Saudi | 29.4759 | 9.3226 |
| Non-Saudi | 31.4605 | 9.7334 |

The mean and the standard deviation for Saudi students were 29.47 and

9.3, while the mean and the standard deviation for non-Saudi were 31.4605 and 9.7334, respectively. Note that these differences in chemistry between Saudi and non-Saudi in grade 10 were the same as the differences between Saudi and non-Saudi in grades 11 and 12. No statistical interaction was found to exist between grade levels and nationality. The hypothesis that tested the differences in chemistry achievement between Saudi and non-Saudi was rejected.

1. there is a significant difference between Saudi and non-Saudi students in chemistry achievement.

Table 17 reports the means and the standard deviations in physics achievement by nationality and grade level.

Table 17
Means and Standard Deviations in Physics Achievement
by Nationality and Grade Level

| | | Mean | Standard Deviation |
|---|---|---|---|
| Saudi: | | | |
| Grade | 10 | 25.9605 | 8.2655 |
| Grade | 11 | 32.0926 | 8.2822 |
| Grade | 12 | 29.5273 | 10.1203 |
| Non-Saudi: | | | |
| Grade | 10 | 30.6149 | 10.6240 |
| Grade | 11 | 30.4818 | 7.6346 |
| Grade | 12 | 29.8455 | 9.1560 |

The hypothesis that tested the differences in physics achievement between Saudi and non-Saudi students in grades 10, 11 and 12 was rejected. In other words, it was concluded that:

1. There was no significant difference between Saudi and non-Saudi students in physics achievement.
2. From Table 13 since there was no interaction between grade level and nationality, the null hypothesis was retained.

Means and the Standard Deviations in Physics Among
Saudi and Non-Saudi (grades 10, 11, and 12)

Univariate F tests for the nationality factor indicated that there were differences in attitudes (posttest) and chemistry between Saudi and non-Saudi students in grades 10, 11, and 12. Table 18 shows the *p* value associated with the dependent variable, physics.

Table 18

Dependent Variable: Physics and *p* Value

| Dependent Variable | *p* Value |
|---|---|
| physics | .232 |

From Table 18, it can be seen that the p value is larger than the level of significance ( $\alpha$ =.05), one can conclude that the null hypothesis was retained.

The Relationship Among the Dependent Variables

To examine the relationship among the dependent variables, they were tested by employing Pearson product-moment correlation. The results of the analusis is presented in Table 19.

Table 19

Correlation Among Dependent Variables

| | Attitude (pre) | Attitude (post) | Chemistry | Physics |
|---|---|---|---|---|
| Attitude (pre) | | | | |
| Attitude (post) | -.0077 (p=.889) | | | |
| Chemistry | -.0116 (p=.832 | -.0436 (p=.427) | | |
| Physics | -.0415 (p=.450) | -.0282 (p=.608) | .7546 (p=.000*) | |

If p value is less than or equal to .05, then the null hypotheses may be rejected. In this case p = .000 (which really means p ≤.001), which shows a significant correlation between chemistry and physics achievement. This is the

only significant correlation that was found. The estimate sample correlation was .7546.

In conclusion, the result of this analysis revealed the following:

1. There was a significant difference between Saudi and non-Saudi students in chemistry achievement.
2. There was no significant difference between Saudi and non-Saudi students in physics achievement.
3. There was no statistical interaction between grade level and nationality with respect to posttest attitude and achievement in chemistry and physics.
4. A strong significant correlation was found ($r$ = .7546) between chemistry and physics achievement.

# CHAPTER V

# SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

The purpose of this study was to compare students' attitudes toward science and science achievement in chemistry and physics and to examine the possible relationship between attitudes toward science and science achievement among Saudi and non-Saudi Arabic students in grades 10, 11, and 12. In other words, the problem being investigated was as follows: (a) to develop a valid and reliable attitude toward science instrument for use with Arabic students at the secondary school level, (b) to compare differences in attitudes toward science and achievement in physics and chemistry in grades 10, 11, and 12 among Saudi and non-Saudi Arabic students in secondary schools in Riyadh, Saudi Arabia, and (c) to determine the relationship between measures of students' attitudes toward science and achievement in physics and chemistry in grades 10, 11 and 12. This chapter contains a summary of the study, the conclusions, a discussion of the findings, recommendations for further study, and suggestions for future research.

## Summary

The intent of this study was to investigate differences between Saudi and non-Saudi students in secondary schools in Riyadh with respect to attitudes toward science and science achievement in chemistry. The population of this

study consisted of 334 students, 166 Saudi and 168 non-Saudi, involving eight secondary schools in Riyadh City. They were from a total population of 2252 students attending grades 10, 11, and 12. There were 115 students consisting of 57 Saudi, and 58 non-Saudi in grade 10; 109 students consisting of 54 Saudi and 55 non-Saudi in grade 11; and 110 students consisting of 55 Saudi and 55 non-Saudi in grade 12.

The instruments used for the study were an attitude toward science and science achievement in chemistry and physics. Science achievement tests in chemistry and physics were developed by the teachers. The attitude toward science instrument was developed by using and modifying different items from an unpublished manual by Haladyna and Shaughnessy (1982), and the WASP: Wareing Attitude Toward Science Protocol (Wareing, 1982). A panel of 25 experts in the field of Saudi and non-Saudi science education determined the content validity. The instrument was translated into the Arabic language and given to experts in the Center of Educational Development to check the precision of the translation into the Arabic language. The reliability of the instrument was determined using the Hoyt and Stunkard Technique.

Science achievement tests in chemistry and physics for grade 12 were designed by experts in the field of science in Riyadh Educational Directorate. Science achievement in chemistry and physics for grades 10 and 11 was designed by classroom science teachers. No effort was made to calculate their validity and reliability, but the content was verified through content validation by the Delphi technique.

Three types of statistical analysis were used in this study. Two-way Analysis of Covariance was used to determine the differences in attitudes toward science between Saudi and non-Saudi Arabic students in Riyadh in grades 10, 11, and 12. (2) Multivariate analysis of covariance was used to determine the differences in achievement between Saudi and non-Saudi students attending grades 10, 11, and 12. (3) Pearson product-moment correlation was calculated to find the relationship between attitudes toward science and science achievement.

## Conclusions

The first three hypotheses, as mentioned earlier in Chapter III, were designed to find the differences in attitudes toward science between Saudi and non-Saudi Arabic students in secondary schools. The analysis of these hypotheses revealed the following:

1. Students held negative attitudes toward science.
2. Saudi students held more positive attitudes toward science than their counterpart non-Saudi Arabic students.
3. There was a significant difference in attitudes toward science between Saudi and non-Saudi students attending grades 10, 11, and 12 in secondary schools in Riyadh City.
4. There was no significant interaction between nationality and grade level.

Three null hypotheses were designed to determine differences in science achievement between Saudi and non-Saudi Arabic students. The analysis of these hypotheses revealed the following conclusions:

1. Non-Saudi students scored higher in chemistry achievement than Saudi Arabic students.
2. No significant differences were found in physics achievement between Saudi and non-Saudi Arabic students in grades 10, 11, and 12.
3. Strong significant positive correlation was found to exist between chemistry and physics achievement: $r = .7546$.

## Discussion of the Findings

The findings of this study must be interpreted within the introduction of the acceptable but moderate reliability level of the attitude toward science instrument. The findings indicated that all students involved in the study had negative attitudes toward science. Saudi students tend to have more positive attitudes than their counterparts, the non-Saudi Arabic students. Some factors may explain the students' negative attitudes toward science. First, science curricula tend to neglect the affective domain in school settings. Second, most of the teachers in the classroom do not try to reflect positive attitudes toward science to their students at the beginning of science class period. This may be partially the result of heavy schedules and a class period that do not permit them to be more

flexible in their teaching. Third, the traditional teaching method is the most widely used in the schools. Some teachers do not practice learning by doing in their science teaching.

> According to Harty and Al-Faleh (1983), in Saudi Arabia little variety exists in the methods of teaching secondary school science. The lecture method is used most of the time; lecture demonstrations are used occasionally. Laboratory teaching is basically done by the way of demonstration. (p. 861)

Fourth, teachers are the only ones who perform experiments in front of the students, which contradicts the concept of modern education. This may account for negative attitudes toward science.

Even though all students held negative attitudes toward science, Saudi students held more positive attitudes toward science. According to Al-Rasheed (1983), the positive affective behavior of the students may be the result of the following:

1. The study of the subject matter in the school
2. The positive and rapid development of the individual in Saudi Arabia through new technology.
3. An increase of parent awareness of the necessity of science and, thus, a positive influence on their children.
4. The results of media (e.g., radio and television programs and newspaper reports) coverage of new scientific developments. (p. 111)

Science Achievement

The findings of the science achievement in chemistry indicated that the non-Saudi Arabia students achieved better than Saudi students. Non-Saudi students tend to have an educated family who came to Saudi Arabia to work as teachers, professors, and professional workers. They are more likely to help their children in school subject matter.

The flow of oil in the last ten years has had its impact on the structure of society as well as education. Students have tended to drop out of school because jobs were available for everybody with different privileges. They attended schools temporarily only because of the wishes of their families.

Saudi society is a very covservative society and children are dependent upon their parents. For some children, science is not important, which hinders the Saudi Development Plan. According to Okaz in speaking of December, 1983 (as cited by Karimi, 1983), "even though there are seven universities in the kingdom, there is still a need for more qualified, specialized professional graduates. More than 9,000 physicians were considered necessary by the end of the second development plan, but only 55 graduated" (p. 33).

The lack of interest in science, especially Saudi students, led some students to major in the humanities. According to the scientific seminar for education held by the Ministry of Education (as cited by Karimi, 1983) "these is a surplus in the humanities and social sciences and a corresponding shortage in the science and natural sciences" (p. 34).

The findings of science achievement in physics indicated that there were

no significant differences between Saudi and non-Saudi students. It seems that the nature of the physics curriculum is harder for students than the chemistry curriculum, which deals mostly with memorization. The findings of science achievement in chemistry, however, showed significant differences between nationality, with non-Saudi achieving higher. These differences might be due to the abundance of companies in the country that seek university graduates who are chemistry majors.

The findings of the correlation of the dependent variables indicated there was no significant correlation between attitudes toward science and science achievement. Attitudes toward science was not a strong factor causing higher or lower achievement in science. Such an approach may improve students' attitude toward science.

## Recommendations

Since Saudi and non-Saudi students belong to the same culture, traditions, values, religion, and speak the same language, the following recommendations for fostering attitudes toward science will be discussed under the following catagories:

1. Science curricula should reflect the affect domain in science teaching. Attention should be focused on the integration of affective, cognitive, and psychomotor domains.
2. Science curricula should provide students with the experiences, skills,

and abilities needed for everyday life as well as preparation for becoming future scientists and engineers.

3. Science curricula should reflect the needs and goals of the Saudi Arabian society.
4. Science curricula should reflect, in detail, the work of the Moslem pioneers, especially those in science, their thinking, approaches, and their determination that led them to the discovery of modern science.

Improving the Science Laboratory

1. As John Dewey said, "the best learning is by doing." Students should have the opportunity to apply technical knowledge in laboratories. Laboratory experience should inspire independent thinking by providing students with a variety of approaches toward thinking independently, to apply, to synthesize, and then to evaluate.

2. The Ministry of Education which is the official agency responsible for boys' education should act to improve schools, especially in the remote areas. Laboratories in these schools are poorly equipped and far from satisfactory. Schools should be treated equally under the fundamentals of education.

## Suggested Future Research

1. The study was limited to tenth, eleventh, and twelfth grade male students in Saudi secondary schools. The study should be replicated in junior high and elementary schools.

2. A study should be done to determine the attitudes toward science and science achievement between males and females in secondary schools.

3. A study should be done to compare Saudi and non-Saudi students' attitudes using different variables such as demographic variables that could clarify the findings of such a study.

4. A study should be done to determine the differences in attitudes and science achievement using a large sample that could cover all secondary schools in Saudi Arabia.

5. Research should be done to evaluate the attitude toward science curricula in secondary schools in Saudi Arabia.

6. More attention should be given to the validity and reliability of the instrument to measure attitude toward science. A larger pool of items should be added to raise the reliability of the instrument.

7. Although the achievement instruments were assumed to be valid and reliable, standarized achievement tests in physical science should be constructed for all grade levels. Future study might use these standarized tests and compare Saudi and non-Saudi Arabic male students' attitude toward science and achievement.

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# APPENDICES

# APPENDIX A

## PERMISSION LETTER

Using Wareing attitudes toward science protocol

STOUGHTON PUBLIC SCHOOLS
232 PEARL STREET
STOUGHTON, MASSACHUSETTS 02072
344-4000

CAROL WAREING, Ph. D.
ASSISTANT SUPERINTENDENT OF SCHOOLS
FOR CURRICULUM AND INSTRUCTION

April 7, 1986

Mr. Mohammed Alshargi
4000 N.W. Withams Hill Drive
Apartment #10
Corvallis, Oregon 97330

Dear Mohammed,

As per our conversation of March 3 and April 4, 1986, respectively, you have my permission to use the WASP for your research. I would, however, appreciate receiving a copy of the study results.

If I can be of further assistance, please advise.

Sincerely,

Redacted for privacy

Carol Wareing, Ph.D.
Assistant Superintendent
of Schools

CW:mjm
Enclosures

# APPENDIX B

## PERMISSION LETTER

Using Haladyna, Olsen and Shaughnessys' theoretical frame work and attitudes toward science instrument

MEMORANDUM

TO : The Committee of Mohammed R. Al-Sharge
Science Education Department

Redacted for priva

FROM: Joan Shaughnessy

RE : Use of Haladyna, Olsen and Shaughnessy (1982) attitude toward science model

DATE: April 23,1986

My colleagues, Tom Haladyna, Bob Olsen and I all encourage the continuation of research on student attitudes toward science. With the support of the National Science Foundation, we developed the Inventory of Affective Aspects of Schools and a model to explain possible factors affecting the development of student attitudes toward science.

Our instrumentation and findings are described in two published papers: one in Science Education (Haladyna, Olsen and Shaughnessy, 1982) and one in the Journal for Research in Science Teaching (Haladyna, Olsen and Shaughnessy, 1983). I have attached a copy of the instrument used for our 7th and 9th grade sample of science classes.

We welcome Mr. Al-Sharge's use of the instruments in his own research project and trust that his research will shed further light on the usefulness of the model we proposed. We do request that a summary of his findings be mailed to us at the completion of his research.

If we can be of further assistance to Mohammed or to his committee, please contact me at X 4662.

# APPENDIX C

## Attitudes Toward Science Instrument
(English Version)

In the name of God, Most Beneficent
Most Merciful

Dear Student:

Peace be upon you all.

There is a strong relationship between a student's attitude toward science and his achievement. We can make use of this relationship in planning curricula and developing presentations that will result in better science achievement.

As I Prepare for a Ph.D. in Education in the United States of America, I am conducting research about the relationship between attitudes toward science and achievement among Saudi and non-Saudi students in the secondary schools. A goal of this research is to bring about future improvements in the field of science teaching. The success of a considerable part of this research rests upon your cooperation in answering the attached questions concerning your attitudes toward science.

Thank you for the time devoted. I hope you read the enclosed instructions and fill out the special form attached.

Sincerely yours,

Mohammed R. Al-Shargi
The Junior College
Science and Math Center
Riyadh

# Criterion Specifying High School Students' Attitude Toward Science

---

## "Important Instructions"

Dear Students,

The following questions aim to know your attitudes toward science. They are in the form of sentences which I hope you will read carefully and answer honestly, knowing that your answers won't in any manner affect your grades in these subjects. On the contrary, they will help your future career if it is God's will.

Therefore, try to give correct answers without being affected by any external resources.

Dear Student,

Each paragraph of this criterion contains five choices. Read the paragraph carefully, then place (x) in one of the five squares as follows:

| | Stongly Agree | Agree | Un-decided | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| 1. If you strongly agree with what is contained in the sentence, place an (x) in the first box. | X | | | | |
| 2. If you agree to what the sentence states, place an (x) in the second box. | | X | | | |
| 3. If you are not sure of your feeling towards the sentence, place an (x) in the third box. | | | X | | |
| 4. If you disagree with the sentence, place an (x) in the fourth box. | | | | X | |
| 5. If you strongly disagree with the sentence, place an (x) in the fifth box. | | | | | X |

Important Instructions:

1. Give one answer to each sentence, try not to give undecided for most of the sentences.

2. Try to free yourself on any external resources that might affect your answer.

3. Be true to yourself while answering and remember that the results of this research won't affect your grades.

4. Remember that this research aims to know your attitudes toward science, not to the teacher. Therefore, avoid the effect of the teacher's personality on your decision.

Thank you for your co-operation.

School:
Grade level:
Nationality:

| | Stongly Agree | Agree | Un-decided | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| 1. Scientific subjects are essential for the improvement of our society. | ☐ | ☐ | ☐ | ☐ | ☐ |
| 2. Studying science prepares us for the future. | ☐ | ☐ | ☐ | ☐ | ☐ |
| 3. We can control diseases by science. | ☐ | ☐ | ☐ | ☐ | ☐ |
| 4. Studying science is important for the scientific age we are living now. | ☐ | ☐ | ☐ | ☐ | ☐ |
| 5. Reading science is tiresome for me. | ☐ | ☐ | ☐ | ☐ | ☐ |
| 6. Science encourages curiosity. | ☐ | ☐ | ☐ | ☐ | ☐ |
| 7. Studying science helps us to study the environment. | ☐ | ☐ | ☐ | ☐ | ☐ |
| 8. I can't concentrate when reading scientific subjects. | ☐ | ☐ | ☐ | ☐ | ☐ |
| 9. Studying science makes life complicated. | ☐ | ☐ | ☐ | ☐ | ☐ |
| 10. Scientific experiments are hard to understand. | ☐ | ☐ | ☐ | ☐ | ☐ |
| 11. Studying science is a waste of time. | ☐ | ☐ | ☐ | ☐ | ☐ |
| 12. There are no scientific activities in my class. | ☐ | ☐ | ☐ | ☐ | ☐ |
| 13. Students study science because they are forced to. | ☐ | ☐ | ☐ | ☐ | ☐ |

# APPENDIX D

## Attitudes Toward Science Instrument
(Arabic Version)

بسم الله الرحمن الرحيـــــم

أخي الطالـــــب...

السلام عليكم ورحمة الله وبركاته وبعد...

هناك علاقة بين اتجاهات الطلاب نحو المواد الدراسية وبين تحصيلهم فيها. ويمكن الاستفادة من هذه العلاقة في تخطيط مناهج المادة الدراسية وتكييف طرق تقديمها وتدريسها حتى تكون محققة للاهداف المرجوة منها.

وحاليا أقوم ضمن دراستي للحصول على درجة الدكتوراه في مجال التربية من الولايات المتحدة الامريكية ببحث حول العلاقة بين الاتجاهات نحو مادة العلوم والتحصيل فيها في المرحلة الثانوية والافادة من ذلك مستقبلا في مجال التدريس والعمل. ويعتمد نجاح جانب كبير من هذا البحث على مساعدتك في الاجابة على الاسئلة المرفقة مع هذا الخطاب حول انطباعاتك واتجاهك نحو مادة العلوم.

آمل منكم التكرم بقراءة التعليمات المرفقة ضمن هذا الخطاب وتعبئة الاستمارة الخاصة بالاتجاهات العلمية.

أشكر لك تعاونك والوقت الذي تتفضل به...

ولك تحياتـــــي،،،

محمد راشد الشرقي
الكلية المتوسطة ومركز العلوم والرياضيات
بالريـــــاض

بسم الله الرحمن الرحيـــــم

## مقياس تحديد الاتجاهات نحو مواد العلوم لطلبة الثانوية العامة

### "تعليمات هامـــــة"

أخي الطالب:

" ان الاسئلة الاتية تهدف الى معرفة اتجاهك نحو بعض مواد العلوم التي تدرسها في مدرستك ... وهذه الاسئلة عبارة عن جمل, نأمل أن تقرأها بعناية وأن تكون اجابتك عليها أمينة مع ملاحظة أن نتيجة هذه الاداة لن تؤثر من قريب أو من بعيد على درجاتك في هذه المواد, بل ستكون الاداة مفيدة لمستقبلك الدراسي ان شاء الله. لذلك احرص أن تكون اجابتك نابعة من ذاتك وبعيدة عن أي تأثير خارجي."

أخي الطالب:

"لكل فقرة من فقرات المقياس خمسة خيارات موجودة .. اقرأ كل فقرة بعناية, بعد ذلك ضع علامة (x) في واحدة فقط من المربعات الخمسة الموجودة حسب الاتي:ـ

| | غير موافق اطلاقا | لا أوافق | غير متأكد | موافق | موافق تماما |
|---|---|---|---|---|---|
| أ) اذا كنت غير موافق اطلاقا على ما تحتويه الجملة ضع علامة (x) في المربع الاول بمعنى غير موافق اطلاقا. | x | | | | |
| ب) اذا كنت غير موافق على ما تحتويه الجملة ضع علامة (x) في المربع الثاني بمعنى لا أوافق. | | x | | | |
| ج) اذا كنت غير متأكد من اتجاهك نحو الجملة ضع علامة (x) في المربع الثالث بمعنى غير متأكد. | | | x | | |
| د) اذا كنت موافقا على ما تحتويه الجملة ضع علامة (x) فى المربع الرابع بمعنى موافق. | | | | x | |
| هـ) اذا كنت موافقا تماما على ما تحتويه الجملة ضع علامة (x) في المربع الخامس بمعنى موافق تماما. | | | | | x |

ملاحظات هامة :

١- أجب على كل جملة اجابة واحدة فقط وحاول أن لاتجيب "بغير متأكد" في غالبية الفقرات.

٢- حاول أن تتجرد من أى عامل خارجى يؤثر على اختيارك الصحيح واجعل رأيك الشخصي هو مصدر قرارك.

٣- كن صادقا مع نفسك اثناء اجابتك وتذكر أن نتيجة هذه الاداة لن يكون لها أى تأثير على درجاتك.

٤- تذكر أن الهدف من الاداة هو معرفة اتجاهك نحو مواد العلوم وليس نحو مدرس هذه المادة ، لذلك تجنب أن يكون لشخصية مدرس المادة أى تأثير في قرارك.

شكرا لتعاونك...

" اقلب الصفحة واقرأ الاسئلة بتمعن"

١ ـ المدرســـــة :

٢ ـ السنة الدراسية :

٣ ـ الجنســـــة :

| | غير موافق اطلاقا | لا أوافق | غير متأكد | موافق | موافق تماما |
|---|---|---|---|---|---|
| ١) مواد العلوم ضرورية من أجل تمنية مجتمعنا. | | | | | |
| ٢) دراسة العلوم تعدنا للمستقبل. | | | | | |
| ٣) بالامكان التحكم بالامراض عن طريق العلوم. | | | | | |
| ٤) دراسة العلوم مهمة للعصر العلمي الذي نعيشه. | | | | | |
| ٥) قراءة العلوم مرهقة لي. | | | | | |
| ٦) العلم يشجع على حب الاستطلاع. | | | | | |
| ٧) دراسة العلوم تساعدنا على دراسة البيئة. | | | | | |
| ٨) يصعب على التركيز بوضوح عندما أدرس مادة العلوم. | | | | | |
| ٩) دراسة العلوم تجعل الحياة معقدة. | | | | | |
| ١٠) التجارب العلمية صعبة الفهم. | | | | | |
| ١١) دراسة العلوم مضيعة للوقت. | | | | | |
| ١٢) لايوجد نشاط علمي في الفصل. | | | | | |
| ١٣) يدرس الطلبة العلوم لانهم مجبرون على دراستها. | | | | | |