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Measuring the Attitude towards Science in Pakistan A study of Secondary School Students

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Abstract
This study was carried out to assess the attitude of students of secondary classes towards science. The data was collected from seven secondary schools situated in Model Town and Kahna area of Lahore. The sample consisted of 600 students, both male and female drawn from science as well as humanities streams. The instrument used for collection of data was a modified version of Modified Fennema-Sherman Attitude Scales by Diana Doepken, Ellen Lawsky and Linda Padwa[1]. It consisted of 28 items questionnaire to be responded on a 5-point Likert Scale. The analysis of the data was done by using t-test, ANOVA and LSD test. The study revealed that all students of secondary classes had positive attitude towards science. Attitudes of females are even more positive. Similarly students of Science Group have more positive attitude than those of Humanities Group. The study further revealed that parental attitude and school type also contribute towards development of positive attitude of students towards science.
Keywords: Measuring , Attitude , Science , Pakistan, Secondary School Students

1. Introduction

Attitude is commonly defined as a predisposition to respond positively or negatively to things, people, places, events, or ideas.

Attitudes or feelings towards science refer to a person's positive or negative response to the enterprise of science. Put another way they refer specifically to whether a person likes or dislikes science. A seven-item subscale designed by Simpson and Oliver (1990) [1] measures student attitude in terms of *specific feelings* towards science.

- Science is fun
- I have good feelings toward science,
- I enjoy science courses,
- I really like science,

- I would enjoy being a scientist,
- I think scientists are neat people,
- Everyone should learn about science.

Included in the scale are other dimensions related to attitude toward science. One example is *motivation to achieve in science.* Items from this subscale include:

- I always try hard, no matter how difficult the work,
- When I fail that makes me try that much harder,
- I always try to do my best in school,
- I try hard to do well in science.

Another dimension related to attitude toward science is *science anxiety*, the negative pole of the attitude concept. Items in this subscale include:

- Science makes me feel as though I'm lost in a jungle of numbers and words.
- My mind goes blank when I am doing science,
- Science tests make me nervous.
- I would probably not do well in science if I took it in college.

The science attitude of students can include *attitude toward science teacher.* Examples of items representing this dimension include:

o My science teacher encourages me to learn more science, o I enjoy talking to my science teacher after class, o My science teacher makes good plans for us. o Sometimes my science teacher makes me feel dumb, o My science teacher expects me to make good grades. *Attitude toward science curriculum* is another important affective variable. Examples of statements representing feelings are:
o We do a lot of fun activities in science class, o We learn about important things in science class, o We cover interesting topics in science class, o I like our science textbook.

"Thus the attitude is a little thing that may make a big difference." Why positive attitudes towards science are necessary?

Science is a human enterprise that contributes enormously towards extending the intellectual horizons and also in solving many of our practical problems for example:-

i. Science is an important way to understand the world. Understanding means to gain insight into the way all nature works in a causal and mechanistic sense. Science helps us to understand motions in the heavens, the tides, and the movement of terrestrial bodies, the chemical constituents of matter and the nature and evolution of living organisms. There is no other way to understand such objects and processes.
ii. Science attempts to explain natural phenomena in terms of the underlying causes in as economical way as possible - preferably using mathematics. The ideas have to be self-consistent and correspond with reality. They must be tested. Scientifically.
iii. Scientific knowledge is self-consistent. The self-consistency implies that one branch of science must be consistent with all the others; Biological theories cannot contradict Chemistry.

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[1] Simpson, R.D., & Oliver, J. S. (1990). A summary of major influences on attitude toward and achievement in science among adolescent students. *Science Education, 74, 1-18.*

iv. Science is a special form of knowledge. But the differences lie both in the subject matter and the techniques. In science the ideas are value-free.
v. A surprising aspect of science is that almost every important idea can be expressed in a precise manner.

There is hope, even expectation, that science can provide the solution to our many problems: the cure for cancer and other illnesses, cheap and environmentally friendly nuclear power. There also is considerable enthusiasm for popular science books and programmes, which reveal the mysteries of the origin and workings of the universe-including the origins of human beings like ourselves. Science is intellectually exciting.

2. Why negative attitudes towards science are not desirable?

While there is much interest and admiration for science, there is also some fear and hostility. Science is perceived as materialistic and dehumanizing, arrogant and dangerous. Reductionism, a hallmark of scientific research, robs all the mystery and wonders of life.

Some others see its practitioners as a band of cold, competitive and unfeeling technicians wielding power without responsibility. The threats of nuclear war and the genetic manipulation of embryos loom large. Science is also blamed for polluting the environment.

Such attitudes and feelings about science are however uncalled for; that we remain ignorant about many aspects of human behavior is not a failure of science but a reflection of human complexity. What science cannot do is to tell us how to live, what is good or bad. It has nothing to contribute to moral and ethical issues; these can, however, arise in relation to the application of scientific ideas. In principle, if we understood more about how society works, it could help us design a just society once we made clear the ethical and moral principles that we want.

3. Statement of the Study

The purpose of this study is to know and learn the behavior and attitudes of secondary school students towards science learning. So the statement of this research project is ***"A survey of secondary school students' attitude towards science"*** **Significance of the Study**

The attitude of a learner toward a subject determines to a large extent, his/her success and consequently his/her choice of a profession. In most cases this attitude is formed during secondary classes. It is, therefore, important to discover attitudes of students and to try to modify, if possible, through teaching strategies.

4. The significance of the study can be gleaned through the following

i. Student's attitudes towards a subject deeply affect their learning of that subject. So it is needed to know their attitudes, which will be helpful for teachers, curriculum designer and head teachers of schools.
ii. Gender difference in attitudes may be important because females usually feel themselves inferior in science. It may therefore, be useful to know their attitudes. This study will be helpful for females that what attitudes they should adopt and how these attitudes will fulfill their needs.
iii. The study will help to know the attitudes of science students, so that proper emphasis may be given to develop science attitudes.
iv. The findings of the study may provide useful insights to curriculum planners and textbook writers to promote desirable attitudes and counter negative attitudes for improved learning.
v. The study may provide incentives for further researches in this domain.

5. Objectives of the Study

This study is conducted to achieve the following objectives.

i. To measure the attitudes of secondary school students.
ii. To measure the gender difference in attitudes of secondary school students.

iii. To know the relationship, if any, in the type of school and the attitudes of their students towards science.
iv. To study the attitudes of science and non-science students towards science at secondary level to counter some wrong notions that science is a difficult subject or that some students cannot study science at all.

6. Research Questions

i. What are students' attitudes towards science at secondary level?
ii. What are significant differences between students' attitudes towards science at secondary level in Lahore City?
iii. What are significant differences between science and non-science students' attitudes towards science at secondary level in Lahore City?
iv. What are significant differences between 9^{th}, 10^{lh} class students' attitudes towards science at secondary level?
v. What are significant differences between 9^{lh}, 10^{th} class science students' attitudes towards science.
vi. What are significant differences between 9^{th}, 10^{lh} class non-science students' attitudes towards science.
vii. What is gender effect on student's attitudes towards science at secondary level?
viii. What are the effects of fathers' education on students' attitudes towards science at secondary level?
ix. What are the effects of mothers' education on students' attitudes towards science at secondary level?
x. What are the effects of school type on students' attitudes towards science at secondary level?

7. To answer these questions following null hypothesis were formulated

H01 There is no gender effect on students' attitude towards science.
H02 There is no significant difference between science and non-science students' attitudes towards science.
H03 There is no significant difference between 9^{th} class science and non-science students' attitudes towards science.

H04 There is no significant difference between 10^{th} class science and non-science students' attitudes towards science.
H05 There is no effect of fathers' education on students' attitudes towards science.
H06 There is no effect of mothers' education on students' attitudes towards science.
H07 There is no effect of school type on students' attitudes towards science.
H08 There is no significant difference between 9^{lh}, 10th class science and non- science students' attitudes towards science.
H09 There is no significant difference between 9^{th} ,10^{th} class science students' attitudes towards science.
H010 There is no significant difference between 9^{th}, 10^{lh} class non-science students' attitudes towards science.
Since the questionnaire was divided into four sub-groups for detailed analysis the researcher formulated null hypothesis with respect to four sub-groups.

7.1 Sub group No.l: "Self perceptions"

The following null hypotheses were formulated.

Ho1 There is no significant difference between science and non-science students' self perceptions at secondary level.
$H_0$2 There is no significant difference between male and female students' self- perceptions about science at secondary level.

$H_0$3 There is no significant difference between 9th, 10th class students' self- perceptions about science.
$H_0$4 There is no effect of school type on students' self-perceptions about science.
H_{o5} There is no effect of father education on students' self perceptions about science.
H_{o6} There is no effect of mother education on students' self perceptions about science.

7.2 Sub group No.2: "Future expectations"

The following null hypotheses were formulated.

H_{01} There is no significant difference between science and non-science students' future expectation from science at secondary level.
$H_0$2 There is no significant difference between male and female students' future expectations from science at secondary level.
$H_0$3 There is no significant difference between 9lh and 10th class students' future expectations from science.
Ho4 There is no effect of school type on students' future expectations from science.
$H_0$5 There is no effect of father education on students' future expectations from science.
$H_0$6 There is no effect of mother education on students' future expectations from science.

7.3 Sub group No.3: "Expectations from teachers"

The following null hypotheses were formulated.

$H_0$1 There is no significant difference between science and non-science students' expectations from teacher at secondary level.
$H_0$2 There is no significant difference between male and female students' expectations from teacher at secondary school level.
$H_0$3 There is no significant difference between 9th and 10th class students' expectations from teacher at secondary level.
$H_0$4 There is no effect of school type on students' expectations from teacher.
$H_0$5 There is no effect of father education on students' expectations from teacher.
Ho6 There is no effect of mother education on students' expectations from teacher.

7.4 Sub group No.4: "Expectations from gender"

The following null hypotheses were formulated.

$H_0$1 There is no significant difference between science and non-science students' expectations from gender role in science at secondary level.
H_0 2 There is no significant difference between male and female students' expectations from gender role in science at secondary level.
H_0 3 There is no significant difference between 9lh and 10lh class students' expectations from gender role in science at secondary level.
H_0 4 There is no effect of school type on students' expectations from gender ro\e in science at secondary level.
H_0 5 There is no effect of father education on students' expectations from gender role in science at secondary level.
H_{o6} There is no effect of mother education on students' expectations from gender role in science at secondary level.

8. Definition of terms

i. Attitude: - Attitude is commonly defined as a predisposition to respond positively or negatively to things, people, places, events, or ideas.
ii. Attitude towards science: - Attitudes or feelings towards science refer to a person's positive or negative response to the enterprise of science. Put another way, they refer specifically to whether a person likes or dislikes science.
iii. Secondary school: - An institution where students learn from class 6 to 10 (age group 6 to 17).
iv. Students: - Regular students of a secondary school.

9. Assumptions

i. Attitude can be negative or positive.
In terms of positive attitude the learner will be high achiever. In terms of negative attitude the learner will be low achiever
ii. Attitude is changeable.
iii. Attitude can be changed due to learning.
iv. Attitude can be changed due to experience.
v. The study will help teachers to give more emphasis on learning in affective domain.

10. Delimitations of the study

The study will be delimited to: -

i. The population and sample will be male & female students studying in different secondary schools of Lahore.
ii. The data for the study will be obtained only through a questionnaire.
iii. The study will be limited only to "attitude towards science"
iv. The study will only be conducted in secondary classes such as 9^{lh} and 10th.

11. General Methods and Procedures

i. The investigator will conduct the study through quantitative research method.
ii. The investigator will take the sample through convenient sampling.
iii. For collecting data from the students questionnaire method will be adopted.
iv. The investigator will get filled the questionnaire from students.
v. The investigator will analyze the data through quantitative techniques.

12. Review of Related Literature

12.1 What is Attitude?

According to Kobella (1989)[1], the term attitude encompasses a wide range of affective behaviors (e.g. prefer, accept, appreciate, and commit) and is due to loosely and without basis by some writers. It is also applied in number of contexts and with a variety of meanings.

Vaidya (1989)[2] explained attitude as "a condition of readiness for a certain type of activity". Attitudes held by the individuals may be simple or complex, stable or unstable, temporary or permanent and superficial or fundamental. Judgments based upon insufficient facts are likely to yield wrong results and thereby develop biased attitudes.

Hayes (1995)'" described, "Attitude affect the way in which we perceive the world around us".

Anastasi (1969)[4] defined attitude as, "a tendency to react favourably or unfavourably toward a designated class of stimuli". It is evident that when so defined, attitudes cannot be directly observed, but must be inferred from overt behavior, both verbal and non-verbal.

Rosenberg and Hovland (I960)' express that, "attitudes are typically defined as, predispositions to respond in a particular way towards a specified class of objects".

Being predispositions they are not directly observable or measurable. Instead they are inferred from the way we react to a particular stimulus.

MsGuire (1976)[6] who has reviewed numerous definitions of attitudes concluded that these definitions differ in almost every conceivable important way. Some psychologists define attitudes as inner states, but a few refer to attitudes as consisting of groups of responses. Some define attitudes as a disposition to respond, others considers the response as representing the attitude. Some regard an attitude as having a unity, but others regard it as having a set of distinct components. Some distinguish between attitude and knowledge while others regard both as unified cognitive components.

Fishbein and Ajzen (1980)[7] featured work based on hypothesized relationship among beliefs, attitudes, behavior intentions, and behavior.

13. Characteristics of Attitude

Mohsin (1990)[8] described that the attitude has following characteristic that are commonly accepted:

i. Attitudes are not inborn; they are learned through experience.
ii. Like most psychological concepts, they can be inferred form the observed antecedent stimulus and the consequent behavior pattern. They are thus, of the nature of an intervening variable and a hypothetical construct.
iii. Attitudes have objective reference; one holds an attitude regarding some object person, or issue. In this respect, they differ form motives or personality traits that have subjective reference.
iv. Attitudes differ in valence, having an attitude regarding an object signifies that the person concerned is either favourably or unfavourably disposed towards it. Stated otherwise, attitudes are positive or negative, pro or anti.
v. They orient the organism to the attitude object and channel the energy at the disposal of the organism.
vi. Once formed, attitudes persist in time, they are enduring dispositions and are unlikely to change under ordinary conditions.
vii. From operational point of view, attitudes are manifested in the consistency of responses made to a specific object situation.

14. Importance of Attitudes

The predominant role of attitudes is the determining of our thoughts, memory and learning process. Thus they not only determine the conclusions we derive from facts, but also influence the every fact we are willing to accept.

The concept of attitude includes mental set, task set and intention-determining tendencies of very brief duration as well as the relatively permanent biases of politics, economics, and religion. It is easy to

[1] Kobella, Thomas R. (1989). Changing and Measuring Attitude in the Science Classroom. Research Matters to the Science Teacher, No. 8901. http://www.barst.irg/research/attitude.htm.
[2] Vaidya, Narendera. (1989). The Impact Science Teaching. Now Delhi: Oxford & IBH Publishing Co.
[3] Hayes, Wm A. (1995). Scientific Attitudes. Cleveland: MS 38733. http:// www.riverboathouse.com/dochayes/scithink/wahsat.html.
[4] Anastasi, Anne. (1969). Psychological Testing London: Macmillan Publishing Co.
[5] Rosenberg, Milton J. & Havland, Carl I. (1960). Attitude Organization and Change, An Analysis if Consistency Among Attitude Components. New York: Yale University Press.
[6] MsGuire, W.J. (1976). Attitude change and the information-processing paradigm. In E.P. Hollandrer & R. G. Hunt (Eds.), *Current perspectives in social psychology.* New York: University Press.
[7] Ajzen, I., & Fishbein, M. (1980). Understanding attitudes and predicting social behavior, Engiewood Cliffs, NJ: prentice Hall.
[8] Mohsin, S.M. (1990). Attitude concept, formation and change. New Delhi: wiley Eastern Ltd.

observe that students with attitudes unfavourable to certain things learn them with greater difficulty than those whose attitudes are favourable.

Edwards (1957)[9] verified the hypothesis that people select and remember from a speech those items, which fit their attitudes, rejecting data which conflict with their views.

The relationship between attitude and information suggests that people acquire most readily facts, which are congruent with their views. Being products of education attitudes are basic to many educational activities. Thus progress in any field depends upon attitudes developed in children at school level. Attitudes are seldom exempted today from discussions of student and schooling problems.

15. Components of Attitude

Individuals have many attitudes most attitudes are interconnected in clusters, but some are relatively isolated. Occasionally, attitudes are acquired through one traumatic emotional experience but with little information about the attitude object. Most often they are acquired through a series of lesser emotional experiences and with more information. Some are acquired with very little feeling or emotion and considerable information about the attitude object. (Klausmeier and Ripple, 1971)[10]

".Attitude includes the following components"

15.1 Cognitive Components

The cognitive components consist of ideas and beliefs, which the attitude holder has about the object, Encyclopedia of Educational Research (1992)". Attitudes differ in the extent to which they involve knowledge and beliefs. Some attitudes are highly intellectualized.

Where' as, others are based on large store of incorrect information and false beliefs. The cognitive basis for attitudes may be misinformation. A person may hold an attitude and have no strong feeling about the matter that is; the affective component may be minor. On the other hand, his attitudes may not only be highly intellectualized, but may also have a strong affective component. The intellectual component and the affective components work hand in hand, but they are still independent components. The intellectual component of attitude sometimes referred to as the cognitive (knowing) components. Hence, the cognitive component of an attitude is that aspect which is based on knowledge or derived from it in some way. (Travers, 1977)""

15.2 Affective Components

Travers (1977) explained that affective components consist of positive or negative affects (feelings). Attitudes may differ in the extent to which they involve such affective components. Some attitudes are quite irrational and involve little except this affective component. The person who like one set of ideas and dislikes another, but cannot tell why, reflects an attitude that has a major affective component but very little else. Many attitudes are of this nature, and common observation suggests that they are quite easily learned; most people are characterized by many attitudes that are of this character.According to Encyclopedia of Educational Research (1992)[14], 'affective component refers to the feelings and emotions one has towards the object.

15.3 Action Components

Behavioral or Action component consists of one's actions and tendencies towards the object. (Encyclopedia of Educational Research, 1992) [1:1]

According to Travers (1977)[16] many expressed attitudes bear little relation to behavior. The fact that the action component can be independent of the other components is important for planning education. Much of attitude education is the education of the affective and the cognitive components of attitudes, and these components may never be carried over into action systems. The action system of an attitude may have little support from the cognitive system, which may be almost entirely laming.

[1] Edward, Allen L (1957), the social desirability variable in personality assessment and research. New York: Dryden Press.

[10] Klausmeier. Herbert J. & Ripple, Richard E. (1971). Learning and Human Abilities, Educational IPsycholigy. New York: Harper and Row Publisher. (3rd Edition)

" Alkin, Marvin C. (1992). Encyclopedia of Education Research. Vol. I, New York: Macmillan Publishing Co.

Gagne & Medsker (1996)[17] suggested that these three components of attitude are considered as highly interrelated and believed that all three may be usefully addressed in attitude development.

16. Measurement of Attitude

Usually measurement of attitudes is carried out through verbal behavior.

Edwards (1957)[10] defined, measurement of attitudes as "the degree of positive or negative effect associated with some psychological object". So measures of attitude are measures of effect and hence do not attempt to measure either the cognitive component or the action component of attitude.

Verbal behavior may be used in many ways in the determination of underlying attitudes. Any expression of opinion provides a small amount of evidence and it can be obtained by asking a person whether he agrees or disagrees with a particular statement of opinion. Series of opinions are ordered into scales with respect to particular issues. Such ordered sets of statements are referred to as attitude scale. They are used to appraise attitudes as asking subjects to examine each statement and to indicate agreement or disagreement. An examination of these responses can then be used to provide a measure of attitude. It is clear that endorsement of extreme statements would indicate an extreme attitude. On the other hand, the endorsement of statements nearer a middle position indicates a corresponding scale position of attitude.

Thurstone (1927, 1928)[g] suggested, "Attitudes can be measured" by using techniques that generate interval levels, i.e, scales of people's attitudes or values. (Encyclopedia of Educational Research, 1992)[20]

Anastasi (1969) proposed that attitudes can't be directly observed but must be inferred from overt behavior, both verbal and non-verbal.

Attitudes are multidimensional and that appropriate methods are those that uncover the important dimensions underlying the measurement. (Encyclopedia of Educational Research, 1992)[22]

The measurement of attitudes is both difficult and controversial, whether expressed opinions can be regarded as indicators of "real" attitudes has frequently been questioned. This problem concerns the relationship between verbal and non- verbal overt behavior, which may not always provide an accurate index of attitude (Anastasi, 1969)[23].

17. The Opinionnaire or Attitude Scale

According to Encyclopedia of Educational Research, (1992)[24], the commonest type of attitude measurement is the opinion scale based on the assumption that, in general attitudes are reflected in opinion.

An information form that attempts to measure the attitude or belief of an individual is known as opinionnaire or attitude scale. How people feel or what they believe is their attitude, Difficult to describe and measure. Researchers must depend upon what people say and what are their beliefs and feelings? Through the use of questions, or by getting people's expressed reaction to statements, a sample of their opinions is obtained. From this statement of opinion, one may infer or estimate their attitude, what they really believe.

[ls] Edward, Allen L (1957). The Social Desirability Variable in Personality Assessment & Research. New York: Dryden Press.

vi. Thurstone, L. L. (1928). Attitudes can be measured. *American Journal of Sociology*, 33(4), 529-554.
vii. Op. cit.
viii. Op. cit.
ix. Op. cit.

x. Travers, Robert W.M. (1977). Essentials of Learning New York: the Macmilian Publishing Co.
xi. Op. cit.
xii. Op. cit.
xiii. Op. cit.
xiv. Op. cit.

[1] Gagne, Robert M. & Medsker, Karen I,. (1996). The Conditions of Learning. London: Harcourt Brace College Publishers.

Attitude scales yield a total score indicating the direction and intensity of the individual's attitude toward a company, group of people, policy or other stimulus category. In the construction of an attitude scale the different questions are designed to measure a single attitude or dimensional variable, and some objective procedures are usually followed in the effort to approach this goal.

Attitude scales, for example, may provide an index for evaluating different instructional procedures. Or they may be utilized in measuring the changes in student attitudes toward literature, art, different racial and cultural groups, or social or economic programmes (Anastasi, 1969) .

The procedures extensively used for eliciting opinion and attitudes are:

(i) Thurstone Technique
(ii) Likert Scale
(iii) Semantic Differential Scale

18. Likert Scale

Instead of classification of items by a group of judges, items are selected solely on the basis of the responses of subjects to whom they are administered in the course of developing the test. Internal consistency is often the only criterion for item selection, although external criteria may be employed when available (Anastasi, 1969)[26].First a number of statements are collected about a subject. The importance is not of the correctness of the statements but of expression of favorableness or unfavorableness. Then a trial test is administered to a number of subjects. Only those items that correlate with the total test are retained. This testing for internal consistency helps to eliminate statements that are ambiguous or that are not of the same type as the rest of the scale. The attitude or opinion scale may be analyzed by indicating percentage responses for each individual statement. This assigns a scale value to each of the five responses and the instrument yields a total score for each respondent. All statements favoring the above position are scored:

19. Scale value

Strongly agree	Agree	Undecided	Disagree	Strongly disagree
5	4	3	2	1

For statements opposing this point of view, the items are scored in the opposite order:

Strongly agree	Agree	Undecided	Disagree	Strongly disagree
1	2	3	4	5

If an opinionnaire consisted of 30 statements or items, the following score values would be revealing:

30 x 5 = 150 Most favorable response possible 30 x 3 = 90 A neutral response/attitude 30 x 1 = 30 Most unfavorable attitude The score of any individual would fall between 30 and 150, above 90 if opinions tended to be favorable to the given point of view, and vice versa.

20. Influences Contributing to Acquisition of Attitudes

During elementary school years, children's attitude generally is in close approximation of the attitudes held by the significant adults in their world, particularly their parents and family group and their teachers. (Klausmeier & Ripple, 1971)[27]

Craig (1958)[28] suggested that the school and home should provide a wide choice of experiences for children for the behavior patterns formed in the early years of life could become basic patterns for a lifetime. So parents may be thought of as a child's first teacher of science. **Effect of Teacher on Attitude**

The prestige of the parents is soon transferred to the teacher. Personal attitudes of teachers influence the attitudes of their pupils because they tend to resemble them in many respects. So attitudes of teachers are important. (Encyclopedia of Educational Research, 1992)[29]

A science teacher can play a major role in developing scientific attitudes among his students and thus he can do this by manipulating various situations and practicing various elements of scientific attitudes that infuse among the pupils these characteristics. The practical examples given by the teacher leave an indelible mark on the personality of his students. Pupils who engage themselves in wide reading in science develop science attitudes more than those who study textbooks. Thus a teacher should encourage his students to read library books and supplementary books on science.

A student of science gets many opportunities for learning scientific attitudes during this practical period. It is for the teacher to properly use such opportunities for developing scientific attitudes amongst his pupils. He should actively participate in discussion and interpretation of results after the experiment. He must inculcate in his students the habit to postpone judgments in the absence of sufficient evidence to support a hypothesis.

Personal examples of the teacher are perhaps the single greatest force helpful in inculcating the scientific attitudes among his pupils. Students have a great tendency to copy their teachers. So a science teacher must be free from biases and prejudices while dealing with his students. He should have an open-mind and be critical in thought and action in his every day dealings. He should be totally free from superstitions and unfounded beliefs and should be objective and impartial in his approach to his everyday problems. He should be truthful and should have faith in cause and effect relationship. For inculcating the scientific attitudes among his pupils teacher should create a desirable atmosphere for encouraging them in various activities. He should feel pleasure in facing a large number of intelligent questions and answering and explaining them and must avoid snubbing his pupils for asking so many questions. (Yadav, 1992)

21. Effect of Parents on Attitudes

Most people are likely to acquire many of their attitudes in the home in which they are brought up. A large part of the education of children consists in training and conditioning them to take their place in adult society, and parents provide examples, which are constantly before their children. Parental attitudes, may be taken over by children and made their own, and this is one way in which their influence may be exerted.

Freudian theory teaches that the parent's behavior and attitudes to the child are primary elements in the environment in which he works out his adjustments, and there is plenty of evidence to support this.

Although many attitudes are acquired during childhood as a result of home influences, these are not necessarily immutable. Fortunately attitudes change and develop throughout life and parents and teachers help in this process very much. So home, schools and society all have their part to play in the inculcation of attitudes and interests (Evans, 1965)[31].

Since the child is more closely attached to his parents to any other adults, it is plausible that his attitudes would correlate highly with them. These similarities in attitudes are due partly to suggestion and partly to the fact that parents automatically bring the child into certain institutional groups.

Some of the acceptance of parental attitudes by children is due to deliberate instruction. Parents and teachers through facial expression, tone of voice, and other signs of hostility, without open verbal statements of prejudice, apparently communicate many prejudices. Even more important for the development of certain attitudes is the emotional relationship of child and parent. Stodgily concluded that family influences are more potent than such factors as socio-economic status or intelligence in developing children attitudes although social status may be a conditioning factor. (Encyclopedia of Educational Research, 1992) '"

Yadav, M.S. (1992). Teaching of Science. New Delhi: Anmol Publications Pvt. Ltd. " Evans, K.M. (1965). Attitudes and Interests in Education. London: Routledge & Kegan Paul Ltd.

Craig, Gerald S. (1958). Science for the Elementary School Teachers New York: Ginn & Company.

Op.cit.

It must be recognized that behavior may reflect the home and the general background of the children. Frequently children use parent's opinions as reliable information. Adults may display attitudes such as open-mindedness by the way the adults approach the interests of children. A dogmatic parent may cause to lose initiative and independence to become gullible and incurious.

Teachers and parents may teach a great deal through a little behavior. The behavior of small children very frequently reflects the attitudes and behavior of parents. (Craig, 1958)[33]

According to Encyclopedia of Educational Research (1992) [4] Davis and McGinnis studies the effectiveness of parent education on parental attitudes toward children's behavior. They found that only slight changes occurred after participation in child study groups, but that expert instruction was more effective than Lay instruction.

Mohanty (1996)[jr>] proposed that educated parents can provide better facilities for the education of their children:

22. Gender Effects

Motivation is seen as the cognitive area that affects girls' achievement levels in science and competence in mathematic is clearly a primary factor affecting girls' entrance retention, and success in science courses and careers.

Several different sources of gender differences in science participation and achievement, ranging and from cognitive abilities to socio cultural stereotyping of science as masculine, have been identified, through research have gone into science classrooms to delineate differential participation patterns that contribute to two types pf experiences in school science. Those experiences are accumulative, and they compound the difference in out-of-school science activities that have been documented for boys and girls. The result is that many girls do not have equal opportunities to learn science, and their continued lag in achievement reflects that lack of opportunity.

Brickhouse maintains that the myth of objectivity, value-free inquiry, scientific method, and rationality that surrounds science presents students with a false image of science, and, thereby, limits their participation in it. Although she concurs that school science has a masculine image, she suggests three ways in which that image may be changed.

Studying science within its historical and sociological context will allow students to see science as part of their culture.

Students examine current or historical scientific controversies about which scientists have not agreed.

Teaching science and its uses together so that students can see science in relation to the world.

23. Procedure and Methodology

This section deals with procedure and methodology of the research project. It describes in details the different aspects through which the research project has under gone for collecting relevant information and data in order to arrive at reliable conclusion.

23.1 Population of the Study

The population of the study was male and female students of seven secondary schools of Model Town and Kahna areas of Lahore District.

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xv. Op. cit.
xvi. Op. cit.
xvii. Op. cit.
° Mohanty, Susandhya. (1996). Teaching of Science in Secondary Schools. New Delhi: Wiley Eastern Ltd.

23.2 Selection of Sampling

Researcher selected seven schools (four for males and three for females) on the basis of convenient sampling. There were different class sections available in these schools. Some schools have only two sections (one for science & non-science students at 9th class level) and (one for science & non-science students at 10lh class level) and some schools have separate sections for 9th, 10th science non-science students. So the researcher selected different sections if there were many sections and selected all the sections if there were only two sections. Then the researcher selected all the students available in these selected sections as sample of the study. The sample that was selected consists of six hundred secondary school students studying in these secondary schools.

Selected No of sections were 18 and selected No of students were 600(300 male and 300 female). The distribution of sample is shown in the table A.

Table A

School Name	Sections	Science Students	Non Science Students	9th	10th	Male	Fe-male	Sub Total
Govt.Model H/S Model Town Lhr.	02	58	38	96	00	96	00	96
	01	47	00	00	47	47	00	47
Govt. Junior Model H/S Model Town Lhr.	01	43	00	43	00	43	00	43
	01	29	15	00	44	44	00	44
Govt.FD Model H/S Garden Town Lhr.	01	25	00	25	00	25	00	25
	01	00	09	00	09	09	00	09
Govt.Apwa Girls H/S Gor1 Lhr.	01	08	26	34	00	00	34	34
	01	00	20	00	20	00	20	20
Govt.Dar-un-Niswan Girls H/S jail road Lhr.	02	10	40	50	00	00	50	50
	02	11	48	00	59	00	59	59
Govt. Girls H/S Feroze Pur road Lhr.	02	20	48	68	00	00	68	68
	02	34	35	00	69	00	69	69
Govt. H/S Kahna Nau Lhr.	01	00	36	00	36	36	00	36
Grand Total	**18**	**285**	**315**	**316**	**284**	**300**	**300**	**600**

23.3 Tool of Research

This study was a survey research so for the collection of relevant data and information a comprehensive questionnaire was downloaded from Internet. It had 47 items with five options per statement starting from Strongly agree (SA), Agree (A), Undecided (U), Disagree (D), Strongly Disagree (SD). This scale was discussed with the adviser of the study. After consultation the scale was translated in Urdu and short down to 28 items due to some contrast in the statements. Students have to response each item on a five points Likert Scale, already discussed. The questionnaire was prepared for male and females students by using particular language altered at appendix A & B.

For more detailed analysis 28 questions were divided in four sub groups.

	Sub group	Item No
(1)	Self perceptions	1 9
(2)	Future expectations	10 14
(3)	Expectations from teacher	15 19
(4)	Expectations from gender	20 28

23.4 Administering the Questionnaire:

The researcher administered the oppionnaire personally in classroom situation. The oppionaire was administered in seven schools out of which four were male and three were female. Instructions to give answer were written on the Questionnaire. The subjects were supported to put a tick mark against each item according to their own choice.

23.5 Procedure:

The study was carried out to assess the attitudes towards science on the basis of male, female 9th, 10th class, science non-science parental education and school type.

The researcher took 600 students from seven different schools of Lahore District. The number of students from which data was collected is given in selection of sampling. In order to check the responses a scoring scheme of the scale was designed by the researcher.

24. ANALYSIS AND INTERPRETATION OF DATA

24.1 Data Analysis:

The data collected on a questionnaire from seven different schools was tabulated and analyzed by applying t-test, analysis of variance and post hoc multiple comparison test.

24.2 T-Test:

The independent sample t-test evaluates the difference between the means of two independent groups with an independent sample t-test, each case must have a score on two variables, the grouping variable and the test variable. The t-test evaluates whether the mean value of the test variable for one group differ significantly from the mean value of the test variable for the second group.

24.3 Analysis of Variance

For one-way (ANOVA) analysis of variances each individual or case must have scores on two variables. A factor divides individuals into two or more groups or levels while the dependent variable differentiates individuals on some quantitative dimension. The ANOVA F-test evaluates whether the group means on the dependent variable differ significantly from each other.

24.4 Post Hoc Multiple Comparison Test

Post-hoc multiple comparison test is used to compare each group's mean difference. If the answer is lower than mean score then there is difference within groups and if the answer is higher than mean score then there is no difference within groups.

25. SUMMARY, FINDINGS, CONCLUSION AND RECOMMENDATIONS

25.1 Summary

The study was designed to determine the attitude of secondary school students towards science. The study of the attitudes also focused on the affects of gender difference, parental education and school type. Similarly affects of science & non-science groups and class difference on attitude towards science were also measured.

The sample was selected on the basis of convenient sampling from seven different schools 600 (300 male & 300 female) students were selected. The questionnaire was down loaded and translated by the investigator in the light of advisor directions. The questionnaire had 28 items and was sub divided in 4 parts. The students had to response on a five point- Likert scale. The investigator administered the questionnaire in classroom situation. The responses of the students were collected and the collected data was tabulated for analysis. Investigator prepared a coding scheme. Data was analyzed through computer

by using SPSS version 6. Analysis of variance, post hoc test of group comparison and independent sample t- test were used to analyze the data.

25.2Findings

Findings of the study are summarized below:

- Average mean score 4.06 indicates that all students' have positive attitude towards science.
- Mean scores (3.9713), (4.1406) and t-value (-4.13) shows a significant difference between male and female students' attitude towards science. It is further evident from the mean values that female students have more positive attitude towards science as compared to male students .
- Mean scores (4.2439), (3.8859) and t-value (9.18) shows a significant difference between science and non-science students' attitude towards science. It is further evident from the mean values that science students have better attitude towards science as compared to non-science students.
- Mean scores (4.2283), (3.8111) and t-value (7.04) shows a significant difference between 9^{th} class science and non-science students' attitude towards science. It is further evident from the mean values that science students have better attitude towards science as compared to non-science students.
- Mean scores (4.2672), (3.9585) and t-value (6.42) shows a significant difference between 10^{th} class science and non-science student's attitude towards science. It is further evident from the mean values that science students have better attitude towards science as compared to non-science students.
- F prob. (0.0353) is 'significant at P<0.05 levels of significance. So it is concluded that father education affects the students' attitude towards science.
- F prob. (0.0304) is significant at P<0.05 levels of significance. So it is concluded that mother education affects the students' attitude towards science.
- F prob. (0.0000) is significant at P<0.05 levels of significance. So it is concluded that school type affects the students' attitude towards science.
- Mean scores (4.0299), (4.0869) and t-value (-1.37) shows no significant difference between 9^{th}, 10^{th} class science and non-science students' attitude towards science.
- Mean scores (4.2283), (4.2672) and t-value (-0.84) shows no significant difference between 9^{th}, 10^{lh} class science students' attitude towards science.
- Mean scores (3.8111), (3.9585) and t-value (-2.40) shows a significant difference between non-science students' attitude towards science. It is further evident from the mean values that 10^{th} class non-science students have better attitude towards science as compared to 9^{th} class non-science students.
- Mean scores (4.3587), (3.8021) and t-value (11.94) shows a significant difference between science and non-science students' self-perceptions about science. It is further evident from the mean values that science students have better self-perceptions about science as compared to non-science students.
- Mean scores (4.0859), (4.0470) and t-value (0.75) shows no significant difference between male and female students' self-perceptions about science.
- Mean scores (4.0116), (4.1318) and t-value (-2.32) shows a significant difference between 9^{th} and 10^{lh} class students' self-perception about science. It is also concluded that 10^{lh} class students have better self-perceptions about science as compared to 9^{lh} class students .
- F prob. (0.0000) is significant at P< 0.05 levels of significance. So it is concluded that school type affects the students' self-perceptions about science
- F prob.. (0.0014) is significant at P< 0.05 levels of significance. So it is concluded that father education affects the students' self-perceptions about science .
- F prob. (0.0449) is significant at P< 0.05 levels of significance. So it is concluded that mother education affects the students' self-perceptions about science
- Mean scores (4.4751), (3.9975) and t-value (9.11) shows a significant difference between science and non-science students' future expectation from science. It is also concluded that science students have better expectations from science as compared to non-science students at secondary level

- Mean scores (4.1333), (4.3153) and t-value (-3.29) shows a significant difference between male and female students' future expectation from science. It is also evident that female students have better future expectation form science as compared to male students at secondary level
- Mean scores (4.1766), (4.2810) and t-value (-1.87) shows no significant difference between 9th and 10th class students' future expectation from science
- F prob. (0.0000) is significant at P<0.05 levels of significance. So it is concluded that school type affects students' future expectation from science
- F prob. (0.0093) is significant at P< 0.05 levels of significance. So it is concluded that father education affects students' future expectation from science
- F prob. (0.0032) is significant at P< 0.05 levels of significance. So it is concluded that mother education affects students' future expectation from science
- Mean scores (4.2281), (3.8902) and t-value (5.41) shows a significant difference between science and non-science students' expectations from teacher. It is also evident that science students have better expectations from teacher as compared to non-science students at secondary level
- Mean scores (3.9073), (4.1940) and t-value (-4.57) shows a significant difference between male and female students' expectation from teacher. It is also evident that female students have better expectations from teacher as compared to male students at secondary level
- Mean scores (4.0160), (4.0920) and t-value (-1.19) shows no significant difference between 9th, 10th class students' expectations from teacher
- F prob. (0.0000) is significant at P<0.05 levels of significance. So it is concluded that school type affects students' expectation from teacher
- F prob. (0.6551) is not significant at P< 0.05 levels of significance. So it is concluded that father education does not affect the students' expectations from teacher
- F prob. (0.2632) is not significant at P< 0.05 levels of significance. So it is concluded that mother education does not affect the students' expectation from teacher
- Mean scores (4.0094), (3.9055) and t-value (2.27) shows a significant difference between science and non-science students' expectation from gender role in science. It is also evident that science students have better expectations from gender role in science as compared to non-science studen
- Mean scores (3.8022), (4.1074) and t-value (-6.89) shows a significant difference between male and female students' expectations from gender role in science. It is also concluded that female students have better expectations from gender role in science as compared to male students at secondary level
- Mean scores (3.9744), (3.9315) and t-value (0.93) shows no significant difference between 9th, 10th class students' expectation from gender role in science
- F prob. (0.0000) is significant at P <0.05 levels of significance. So it is concluded that school type affects the students' expectation from gender role in science
- F prob. (0.5513) is not significant at P< 0.05 levels of significance. So it is concluded that father education does not affect the students' expectation from gender role in science
- F prob. (0.3772) is not significant at P< 0.05 levels of significance. So it is concluded that mother education does not affect the students' expectation from gender roll in science

26. Conclusions

On the basis offinding of the study the following conclusions are drawn.

- All students have positive attitude towards science.
- Female students have better attitude towards science as compared to male students.
- Science students have better attitude towards science as compared to non-science students.
- There is a difference between 9th and 10th class non-science students attitude towards science. 10th class non-science students have better attitude towards science.
- Parental education and school type affect students' attitude towards science.

27. Conclusions of sub-groups

- Science students have better self-perceptions about science, better future expectations from science, better expectations from teacher and better expectations from gender role in science as compared to non-science students.
- Malp and female students have seen self-perceptions about science.

- 10^{th} class students have better self-perceptions about science as compared to 9^{th} class students.
- School type and parental education affect students' self-perceptions about science and future expectations from science.
- Female students have positive future expectations from science, positive expectations from teacher and from gender role in science as compared to male students.
- 9^{th} and 10^{th} class students have same future expectations from science, same expectations from teacher and same expectations from gender role in science.
- School type affects students' expectations from teacher and gender role in science.
- Parental education has no affect on students' expectations from teacher and gender role in science.

28. Recommendations

On the basis of finding and conclusions, the following suggestions are seemed to be reasonable and approachable.

- The teacher should be aware of the affect that the children reflect the attitude of adult members of their family and home.
- The attitude to be taught must be identified and planed for.
- Pleasant emotional experience should accompany the learning of attitude.
- Instead of product approach the teaching of science at secondary level should be based on process approach.
- Learning material must be selected on basis of knowledge, skills and attitude to be learned.
- The teacher should relate their teaching to the daily life experience of the students.
- The teacher should encourage the students to construct new equipments and apparatus for the experiment instead of using conventional methods and equipments.
- The modern science magazine, journals, films and videocassette records should be provided to the students for the development of positive attitude towards science and scientists.
- The government should organize adults crash literacy program for uneducated parents.
- There should be full use of mass media in order to eradicate attitude towards science among parents and their children.

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Appendix

The following Secondary Schools were selected on the basis of convenient sampling.

1. Govt. Model High School, Model Town, Lahore.
2. Govt. Junior Model High School, Model Town, Lahore.
3. Govt. F. D. Model High School, Garden Town, Lahore.
4. Govt. A.P.W.A. Girls High School, G.O.R. 1, Lahore.
5. Govt. Dar-un-Niswan Girls High School, Jail Road, Lahore
6. Govt. Girls High School, Ferozepur Road, Lahore.
7. Govt. High School Kahna Nau, Lahore.