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Students' Attitude towards Science and its Relationship with Achievement Score at Intermediate Level

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Abstract

The major objective of this research was to find out attitude of students towards science and its relationship with achievement score at intermediate level. The sample comprised of 3,960 intermediate science (pre-medical) students selected from different higher secondary schools and colleges in the province of Punjab, Pakistan. An Urdu translation of the Test of Science-Related Attitude (TOSRA) was used to measure the science related attitude of students. The achievement score of respective students was obtained from the 12th grade results of different Boards in Punjab. The Internal Consistency of the instrument was calculated using Cronbach Alpha Reliability Coefficient. Factor Analysis with Varimax Rotation was used to examine the internal structure of the TOSRA. Simple correlation (r), multiple correlation analysis and standardized regression coefficients (β) were used to investigate the relationship between students' attitude with their achievement score. The results revealed that science related attitude had a significant and positive relationship with the achievement score of science students.

Key words: Attitude towards Science, achievement, TOSRA, students' attitude

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Introduction

The word 'attitude' is often used in the academic life of students. Thurstone (1928) defined attitude as "the sum total of one's inclination and feelings, prejudice and bias, preconceived notions, ideas, fears, threats and convictions about any definite topic" (p. 531). Thurstone (1931) has also defined attitude as "the effect for or against a psychological object" (p. 261). Thurstone (1946) changed his previous definition with a new concept of attitude as "the intensity of positive or negative effect against a psychological object" (p. 39). Choppin and Frankel (1976) have also described attitude as, "it is almost universally acknowledged that educational objectives in the affective domain - those dealing with attitudes, interests and values ---- are of great importance" (p. 57).

It is an important factor for higher secondary and intermediate level students to have attitude and achievement in the science because the understudies need to choose their expert bearers as a consequence for both variables. Many researchers have explored the relationship of attitude and achievement score with respect to science subjects (Dhindsa & Chung, 2003; Eccles, 2007; Ferreira, 2003; Mattern & Schau, 2002; Papanastasiou & Zembylas, 2004). According to Osborne, Simon, and Collins (2003), the topic of attitude has gained a vital attention by researchers for the last few decades in the area of science instruction. They defined as "the feelings, beliefs, and values believed about an object and the impact of science on society" (p. 1053).

According to Schibeci (1984), two distinct terms, "one of which is scientific attitudes and other is attitude towards science" are utilized for attitudes identifying with science. It was described by Bennet (2003) that attitude towards science mentions the viewpoint of experiences in typical conditions. "There is a considerable consensus of opinion that the promotion of favorable attitude is an important aim of science education. There is confusion about what meaning should be placed on the 'attitude' to science" (Fraser, 1981, p.1).

Osborne et al. (2003) have given a list of components of attitude towards science. These components are "perception of the science teacher, anxiety towards science, the value of science, self-esteem at science, motivation towards science, enjoyment of science, attitudes of peers and friends towards science, the nature of classroom environment, achievement in science and fear of failure on course." Attitude of understudies to science is a critical component that is connected with achievement in science. According to Wong and Fraser (1996), "the most common

line research has been the investigation of association between students' cognitive and affective learning outcomes (p. 92)". Willet (1994) has described that "education is intended to foster learning, to bring about changes in attitudes, achievement, and values" (p. 671).

As per Papanastasiou and Zembylas (2002), "A substantial body of research has accumulated over the last three decades, concerning the importance of various attitudes toward science and the relationships between these attitudes and achievements in science" (p. 470). Attitude is imperative for the achievement in light of the fact that both clue to the determination of professions through the understudies and it was clarified by Parker and Gerber (2000).

Review of the Literature

To study the connection between attitude and achievement score, a research was conducted by Hough and Piper (1982). Five hundred and eighty three intermediate students were approached to gather data by using pre and posttests. The results demonstrated that there was a critical affirmative connection between attitudes of understudies and achievement ($r = 0.45$). The students who have positive attitude toward science secured higher achievement score. Contrary to this, students having negative attitude toward science received low achievement score.

A meta-analysis was performed by Willson (1983) to explore the relationships between attitude and achievement. ANOVA was used. The results revealed that attitude and achievement had significant and positive relationship. It was shown that the association between attitude and achievement score was high from grades 7 to 11 and small at elementary level.

The same type of study was conducted in North California by Oliver and Simpson (1984) to investigate the impact of attitudes on achievement in science. During the years 1980-1981, about 5000 students participated from 6-10 classes for data collection. The result found a positive impact of science related attitude on achievement score of students.

An alternative longitudinal study was conducted by Simpson and Oliver (1990) and 178 science classes were selected for data collection. More than 4000 students from classes 6-10 participated in the study. This longitudinal study demonstrated that boy's achievement was additional inspirational attitude and their success in science was higher than girls. The outcomes concluded from grades 6-10, the attitude towards science was less affirmative.

Another meta-analysis was also conducted by Weinburgh (1995) to explore the achievement-attitude relationship. Six hundred and seventy five studies were performed. The results showed that the mean relationship among attitude and achievement was .55 for the young female students and for young male students, it was .50. The relationship was found higher in young ladies than for young men in the subjects of physics and biology.

The correlation of attitude in the direction of science with achievement score in science was explored by Freedman (1997). Twenty physical science classes were used to collect data and the results revealed a positive relationship of attitude with achievement score. It was that achievement in science was influenced by means of attitude in the direction of science.

To determine the gender differences in relation of attitude to science with achievement score, a study was conducted by Mattern and Schau (2002) on 1,238 students of seventh and eighth grades. Eight separate schools were selected as sample. Three instruments were used for data collection for measuring students' attitude and two instruments were used for achievement score. The results showed that there was no critical impact of achievement in science on attitude amongst the females and the outcomes were diverse among males. Rana (2002) conducted a research on attitude and achievement score by administering TOSRA on students of higher secondary and intermediate level. It was concluded that the relationship between attitudes and their achievement score in science subjects was positive at higher secondary level.

Gender orientation issues regarding attitude and achievement was also analyzed by Ferreira (2003). Attitude and achievement score were found to positive and strong association with each other. Among center schools in South Florida, the connection among attitude and achievement score was investigated by Eccles (2007). To measure the attitude towards science, TOSRA by Fraser (1981) was used. The Attitude of the students in the direction of science subjects was positively significant and their achievement scores were higher.

Another research study was conducted by Ali (2012) in Pakistan on 10^{th} grade science students. A sample of 1,885 students was used for the purpose of data collection and Urdu translation of TOSRA was used for the purpose of measurement of students' attitude towards science subjects. It was concluded that male students had less positive attitude than female students. Similarly, students from urban areas had positive attitude than that of students in rural areas.

Objectives of the Study

The major objectives for this research were to find out the reliability of the instrument and explore relationship between attitude and achievement score of students at intermediate level.

Methodology

The study was correlational in nature and survey method was used to collect the data.

Population

Four districts (Okara, Sahiwal, Faisalabad, and Toba Take Singh) were selected from 36 districts of Punjab Province using fish bowl method. Two male and two female institutes were selected conveniently. So, four institutes were selected from each district. A total of 16 institutes were selected. The population of the study comprised of all the male and female students enrolled at intermediate level and higher secondary level in the year 2014-2015 in public sector institutions in the province of the Punjab, Pakistan. Those students were selected who were studying science subjects i.e. Physics, Chemistry, and Biology. The students studying Mathematics instead of Biology were not included in the study. These students were mature enough and had firm attitude development than students at secondary level.

Sample

The study was conducted on a sample of 3,960 students of 12^{th} grade (2,550 male students and 1,410 female students) studying Physics, Chemistry, and Biology as science subjects. This sample was selected from 16 different institutes of four (04) districts of Punjab.

Instruments

Attitude of students was measured by using an Urdu translation (made by panel of language experts) of the instrument named, “Test of Science-Related Attitudes (TOSRA: Fraser, 1981)”. The TOSRA was used because one of the researchers had already used that instrument during his doctoral studies. The second reason to use the instrument was that the analysis of the doctoral study by the researcher was conducted under the kind supervision of Dr. Fraser, the developer of the instrument (TOSRA). Five subscales “Social Implications of Science, Attitude to Scientific Inquiry, Enjoyment of Science Lessons, Leisure Interest in Science, and

Career Interest in Science" (with 10 items each) of TOSRA were used in this study. On the other hand, students' achievement scores in Physics, Chemistry, and Biology were collected from board examinations.

Data Analysis and Results

The factor analysis for TOSRA is a under:

Table 1
Factor Analysis for the Urdu Version of TOSRA

Item	Factor Loadings				
	Social Implications of Science	Attitude to Scientific Inquiry	Enjoyment of Science Lessons	Leisure Interest in Science	Career Interest in Science
1	0.42				
2	0.50				
3	0.38				
4	0.41				
5	0.38				
6	0.37				
7	0.40				
8	0.42				
9	0.38				
10	0.48				
11		0.39			
12		0.42			
13		0.43			
14		0.38			
15		0.48			
16		0.50			
17		0.51			
18		0.46			
19		0.42			
20		0.48			
21			0.42		
22			0.52		
23			0.38		
24			0.48		
25			0.51		
26			0.38		
27			0.49		
28			0.50		

29			0.39		
30			0.46		
31				0.38	
32				0.35	
33				0.52	
34				0.55	
35				0.47	
36				0.64	
37				0.42	
38				0.55	
39				0.71	
40				0.60	
41					0.55
42					0.47
43					0.33
44					0.47
45					0.70
46					0.67
47					0.45
48					0.56
49					0.58
50					0.62
% Variance	10.56	9.11	8.65	11.43	10.45
Eigenvalue	3.36	2.82	2.92	3.50	3.01

The Table 1 indicates that % of variance for social implications of science is 10.56, for attitude to scientific inquiry is 9.11, for enjoyment of science lessons is 8.65, for leisure interest in science is 11.43, and for career interest in science is 10.45. On the other hand, the eigenvalues for above mentioned five scales of TOSRA range from 2.82 to 3.50. It is also clear from above table that 50 items of TOSRA with five scales have a strong structure.

Table 2 shows the reliability of each scale of TOSRA (Urdu version).

Table 2
Internal Consistency Reliability for Urdu Version of TOSRA

Scales	No. of Items	Units of Analysis	Alpha Reliability
Social Implications of Science	10	Individual	0.72
		Class Mean	0.69
Attitude to Scientific Inquiry	10	Individual	0.62
		Class Mean	0.74
Enjoyment of Science Lessons	10	Individual	0.75
		Class Mean	0.82
Leisure Interest in Science	10	Individual	0.75
		Class Mean	0.89
Career Interest in Science	10	Individual	0.69
		Class Mean	0.80

Sample of 3,960 students in 16 classes

Table 2 indicates that alpha reliability of different scales for Urdu version of TOSRA ranged from 0.62 to 0.75 with the individual student as the unit of analysis and from 0.69 to 0.89 with the class as the unit of analysis. It is also clear from above table that Urdu version of TOSRA has satisfactory internal consistency reliability.

Table 3 shows the relationships of achievement scores with five TOSRA scales.

Table 3
Correlations of Achievement Scores with Five Scales of TOSRA

Scale	Achievement Scores	
	r	β
Social Implications of Science	0.16**	0.11**
Attitude to Scientific Inquiry	0.12**	0.08**
Enjoyment of Science Lessons	0.18**	0.12**
Leisure Interest in Science	0.19**	0.14**
Career Interest in Science	0.11**	0.07**
Multiple Correlation R	0.28**	

*P < 0.05, **P < 0.01, N = 3960

Table 3 shows that all five above mentioned scales "Social Implications of Science, Attitude to Scientific Inquiry, Enjoyment of Science Lessons, Leisure Interest in Science, and Career Interest in Science" were significantly correlated ($p < 0.01$) with science subjects (Physics, Chemistry, and Biology) achievement scores and the relationship was positive. Similarly, there was a significant multiple correlation (R) ($p < 0.01$) between achievement scores with the set of TOSRA scales. The β-values show that the relationship between achievement scores and all scales of TOSRA were positive.

Conclusion and Discussion

It is concluded that five indicators of TOSRA "Social Implications of Science, Attitude to Scientific Inquiry, Enjoyment of Science Lessons, Leisure Interest in Science, and Career Interest in Science" are significantly and positively correlated ($p < 0.01$) with science subjects (Physics, Chemistry, and Biology) achievement scores. Similarly, there is a significant multiple correlations (R) ($p < 0.01$) between achievement scores with TOSRA scale indicators. The β-values show that the relationship between achievement scores and all sub scales of TOSRA are positive. The outcomes of the study supported the past studies that achievement in science subjects are interconnected with attitude in the subjects of science. The results of the study also supported that attitude towards science subjects and achievement in were significantly and positively related (Ali, 2012; Eccles, 2007; Ferreira, 2003; Dhindsa & Chung, 2003; Mattern & Schau, 2002; Rana, 2002).

The value of alpha reliability in the current study justified the prior studies of TOSRA conducted by Fraser (1981) and Rana (2002) in Urdu version of the instrument. The study also sustained the opinions that the values of alpha reliability were similar to the values given in the current study (Eccles, 2007). With the use of TOSRA, correlation of attitude towards science and students' achievement in science were explored by the researchers. To increase the reliability in future study, new indicators may be used. Only science students of pre-medical group at higher secondary school and intermediate level were approached. The study may be conducted for students at all levels to achieve comprehensive results.

Overall results were explored. It may be used to investigate gender differences among students. Students belong to arts subjects may be approached for study. Qualitative research should be used in the future studies. Achievement of students in science may be influenced by Qualitative research.

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