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Attitude towards Science Learning: An Exploration of Pakistani Students

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ABSTRACT

Attitude towards science has been a focus of study for many educational researchers and it ultimately helps to explore the aspects that can be intervened to enhance the students' attitude towards science because a relationship has been reported between students' attitude and science achievement. The variation in results reported by studies regarding attitude towards science and science learning reflect that the demographic variables might have influential effect on attitudes towards science and science learning. The purpose of this study was to explore the Pakistani students' attitude towards science learning. A scale regarding attitude towards science learning (AtSL) with Cronbach's alpha 0.86 was administered to 1233 students of 37 government schools of three districts. The results of this study reflect that attitude towards science learning increases with increase in grade of the students; and female students had higher attitude towards science learning than male students. Paternal education, occupation and students' locality seems to causes no significant difference in attitudes towards science learning of students whereas maternal education and occupation cause significant difference in attitudes towards learning of science.

Key Words: Attitude towards Science Learning; Parental Education and Profession; Urban and Rural Students; Private Tuition.

INTRODUCTION

Science education plays a key role to any country's economic and technological development. Encouraging young people to study science subjects is therefore important for any country's future. Similarly creating classrooms as well as school environments in which young students can "feel positive" and "make sense" of experiences in science lessons (Ramsden, 1998) is important. Ultimately exploring the attitudes and the willingness to engage in science education of school aged students is an area worthy of study.

In fact, there is little consensus over the definition of the attitude (Ramsden, 1998),

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because attitudes are complex and multidimensional (Germann, 1988), and very difficult to measure. Attitudes are mental processes reflecting actual and potential responses (Allport, 1966); assessment of different facets of the social world (Petty, 1995; Myers, 2004; Barron & Byrne, 2004); positive to negative rating of things (Petty, Wegener & Fabrigar, 1997); or mental and neural process influencing on behaviour (Breckler & Wiggins, 1992). Conclusively attitude is a complex process in mind and reflected in behaviour. Some of these complexities need to be explored and described to enhance our understanding regarding attitude because Potter and Wetherell (1987) are of the view that what is being measured of the attitudes is only the tip of the "ice-berg".

Attitudes can be measured in two ways; a) Ajzen and Fishbein (1980) recommend that attitude can be measured in terms of affective domain (attitude towards the object), while behavioural and cognitive component should be assessed separately; b) while Krech et al. (1962) are of the view that attitudes should be measured in term of affective, behavioural and cognitive components collectively (ABC model). The possible reason is that these three components are very closely associated and affect each other. So we measure all the components together to provide a better chance of capturing all the facets of the attitude (Moghaddam, 1998). This approach of measuring attitude towards science learning is adapted in this study and includes ideas about science homework, interaction with the science class teacher, enjoyment and disinterest in science subject etc.

The importance of attitudes in science education is of great importance because once the attitudes are formed they are long lasting and difficult to change (Ajzen & Fishbein, 1980). Attitudes towards science affect students' participation in science and impacting performance in science. Attitudes towards science have been extensively studied (Parkinson et al., 1998; Cokadar & Kulce, 2008) over the last decade and the promotion of favourable attitude towards science, and science learning is increasingly a matter of concern for the educationist (Osborne et al, 2003). Blalock et al (2008) in meta-analysis study have categorized attitude towards science into four areas; a) attitude towards science, b) scientific attitude, c) the nature of science, and d) scientific career interests.

Students' attitude towards science at elementary and secondary schools were extensively studied by Gardner (1975), Frazer and Walberg (1981); Hadden and Johnstone, (1983); Banu (1986); Kelly (1986); Myers and Fouts (1992); Ramsden (1998); Nisimov, (n.d.); Morrell and Lederman (1998); and George (2000) either by quantitative or qualitative method. The most of researches on attitude towards science (and science learning) have reported positive attitude of students towards science (Osborne et al, 2003). The importance of attitude towards science can be recognized from the findings showing positive relationship of attitude towards science and achievement, and students with more positive attitude towards science having sustainable learning that makes them want to continue with those subjects they enjoy (Pell & Jarvis, 2001). A dominant theme in this research area in recent years has been a negative attitude towards science and this is regarded as problematic for science education (Ramsden, 1998) and this forms the impetus for this study in that we want to investigate the reasons and causes for high and low attitude towards science learning in Pakistani scenario.

Most studies have focused on two major aspects while working on the attitude towards science learning; a) To what extent demographic variations contribute in developing attitude towards science learning among students, and; b) How these variations should be used to enhance or develop the attitude towards science learning. Gender, locality, grade, paternal education and occupation are found to be the major sources of variations in development of individual's attitude towards science learning.

Difference in Attitude towards Science Learning on Basis of Gender, Locality, Grade, School Type, Paternal Education, Profession and Private Tuition

When attitude towards science and science learning was studied from the perspective of gender, four major categories were found between male and female respondents, i.e., male has more favourable attitude towards science than female students, female students showed higher attitude towards science learning, male and female students do not differ significantly in their attitude towards science learning, and, on the same scale, male students have better attitude towards science learning on some factors and on other factors female students had better attitude towards science learning.

Gardner (1975) documented gender as the most important single variable related to attitude to science. Smail and Kelly (1984) reported the remarkable differences in liking for different branches of science between male and female students at the end of elementary school. Simpson and Oliver (1990) found that males frequently better scores on the sub-scales that measures attitude towards science than female students, but still argues that both genders believe and perform same way regarding science as a subject. Similarly, Crawley and Coe (1990) also reported in favour of males over female students while comparing their attitude towards science learning. Finding, from a meta-analysis by Weinburgh's (1995), reveals that high performing females had a more positive attitude than male students of the same group.

Houtz (1995) found no significant difference in attitude among male and female students. Johanson (1997) reports differential item functioning between the genders in an attitude to science measure. In an Irish context, Francis and Greer (1999) found that while boys and girls did not differ in their opinion of the importance of science, boys had a more positive attitude to science in the school curriculum and to science as a career. In general, studies have reported that males have more favourable attitude than females, but a minority of studies exist in which no difference was found between them.

A small number of studies have reported on locality and grade of the respondents. Urban schools respondents were marginally better in their attitude than rural schools respondents (Zacharia & Barton, 2004). So school's locality does not seem to be a significant predictor of attitude towards science learning. Ormerod and Duckworth (1975); Brown, (1976); Goodwin, Hardiman and Rees (1981); and Francis and Greer (1999) have reported that students' attitude towards science decreases with an increase in grade of individuals. Similarly, Hadden and Johnstone (1983) have also reported a decline in attitude towards science at the secondary school level. But Ye, Raymonds, Susan and Hanxia (1998) reported that attitude has no direct relationship with a change in grade.

Parental education, occupation and involvement with their children's studies were also found to play a very important role in the development of attitude towards science (George & Kaplin, 1998; Wang & Wildman, 1995) but Banu (1986) in his research in Nigerian schools reported no significant effect of parental education on students' attitude towards science and science learning. Schwirian and Thomson (1972) had reported that the level of mother and father's education has a relationship with attitude towards science learning. No research was found regarding effect of private tuition on attitude towards science learning either in international and national perspectives.

The results of above studies vary from each other slightly and sometimes largely, and it seems that researchers are not still sure to claim that what factor(s) really influence students' attitude towards science or attitude towards science learning. One of the major reasons is that the samples greatly differ from each other on the basis of demographic variables, like parental education and occupation, socio-economic status, cultural and geographical scenario. So it is very important to consider demographic variables while reporting any findings of the research

studies regarding attitude towards science learning and ultimately it will give a more comprehensive picture.

This study looks at school children's attitude towards science learning in Pakistan. In Pakistan, as a developing country, science education remained as an important aspect of every educational policy. From 1st to 8th grades, science is taught as compulsory subject in schools. After 8th grade, choice of science subjects is optional and students can continue their studies in humanities subject in next grades. The enrolment in science subjects to humanities subjects is 2:1 at 9th grade (educational census 2009). It reflects that educational system is still unable to attract the attention of students' attitude towards science and science learning while one of the major objectives of teaching science at school level is to develop students' attitude towards science.

The aim of the study was to analyze the difference of gender, locality, grade, paternal education and occupation and private tuition with attitude towards science learning among students of government schools in Pakistan because maintaining the attitude is easy than transforming the negative attitude to positive attitude in later years (Cokadar & Kulce, 2008).

METHODOLOGY

a) Participants

Participants of the study were from grade 8th and grade 9th students (only science students of 9th grade) of 37 government sector schools of three districts (Table 1).

Table 1. *Overall summary of the sample*

		Government Schools								Total Respondents
		Urban Schools				Rural Schools				
Districts	Gender	Elementary Schools		High Schools		Elementary Schools		High Schools		
Okara	Male	30	--	46	37	20	26	47	30	236
	Female	12	20	38	45	29	27	35	26	232
Sargodha	Male	19	30	57	48	24	18	48	35	279
	Female	30	30	48	54	19	--	29	---	210
Rawalpindi	Male	27	30	40	46	---	---	---	---	143
	Female	30	11	53	39	---	---	---	---	133
Total Respondents		148	121	282	269	92	71	159	91	1233

b) Research Instrument Development and Validation

An attitude towards science learning scale of 54 statements was developed in the national language (Urdu) and pilot tested on 464 students. This resulted in the final attitude towards science learning scale *(AtSL)* consisting of 23 statements (18 positive and 5 negative statements) with each five options i.e. Always, Usually, Often, Rarely, Never.

Further details of the attitude towards science learning scale *(AtSL)* can be seen somewhere else (Zubair & Nasir, 2011). Each school was visited by one of the researchers to administer the attitude scale to both ensure high rate of return and increase the reliability of the data collection. Students were selected randomly, if there were more than thirty in the class at the day of data collection.

Table 2. *Factors name with example and reliability*

Factor Name	Focus	Item number (as in the scale)	Reliability	Statements
Keenness to Learn Science (F1)	Self-focusing, content and class focusing, planning about science learning.	1, 3, 6, 7, 8, 11, 12, 5, 10	0.75	I can focus on science ideas throughout the entire period.
Enjoyment in Science Learning (F2)	Giving importance, liking and feeling pleasure	2,9,13,15,24	0.74	I get really pleasure from science learning.
Disinterest (F3)	Boring and incompletion of homework, avoiding discussion.	16, 19, 20, 22, 23	0.61	Science lessons are boring.
Teacher Interaction (F4)	Taking initiative in discussion and clarification with class teacher.	14, 17, 18, 21	0.66	Whenever I need to know anything about science, I ask from my teacher.
Overall Cronbach alpha of the scale			**0.86**	

N=464

FINDINGS

Findings are discussed in terms of descriptive and statistical analysis as follows;

a) Descriptive

Here is some demographic information regarding the participants with all values in this section expressed as percentages.

About 23% of the respondents' fathers were illiterate and only 17 % respondents' fathers' education was above matriculation (Y10). About 46 % respondents' mothers were illiterate, and less than 7% were having education above matriculation (Y10) (Table 3).

Table 3. *Parental education of the respondents* (%ages)

Relationship with respondents	Illiterate	Primary	Elementary	Matriculation	FA/ FSc	BA/ BSc	MA/ MSc	Other	Did not respond
Father	22.9	8.8	20	30.8	9.2	4.7	2.9	0.2	0.4
Mother	45.6	15.1	17.6	15.1	4.1	2	0.2	-	0.3

The 26.9% respondents' fathers were in government service and 27.4% had personal businesses, while 13.9% of them worked in the agriculture sector. The majority of respondents' mothers worked at home caring for the home and the family (about 93 %) whereas 3% were government servants and about 2% of respondents' mothers were running personal business and working in private offices separately (Table 4).

Table 4. *Parental occupation of the respondents* (%ages)

Relationship with respondents	Government service	Personal business	Private job	Agriculture	Did not do any job	Labour	Other	Did not respond
Father	26.9	27.4	11.2	13.9	-	17.5	2.2	0.8
Mother	2.8	1.4	1.4	-	92.9	1	-	0.4

b) Statistical Analysis

Statistical tests were used to find the mean differences for gender, grade, locality, parental education and qualification, and private tuition.

The t values (-8.445, -8.148, -6.381 & -3.73) were significant at $p<0.001$ in favour of female students for overall scores on *AtSL* scale, and factors of *AtSL* scale; i.e. "Keenness to Learn", "Enjoyment in Science Learning" and "Teachers Interaction" respectively. While male students showed significantly higher level of "Disinterest" than female students ($t=5.018$, $p<0.001$) at attitude towards science learning (Table 6).

When 8th and 9th grades students were compared on *AtSL* scale, 9th grade students on overall scale ($t=-4.024$, $p<0.001$) and on factor "Enjoyment in Science Learning" ($t=-5.37$, $p<0.001$) showed better attitude towards science learning as compared to 8th grade students. This pattern was reversed in favour of 8th grade students for factor "Disinterest" ($t=4.76$, $p<0.001$). The rural students were with higher attitude for factors "Keenness to learn science" ($t=4.651$, $p<0.001$) and "Enjoyment in science learning" ($t=2.338$, $p<0.05$)" of *AtSL* scale as compared to urban students, but overall rural students were marginally higher but not significant ($t=1.374$, $p<0.05$) in their attitude towards science learning than rural respondents (Table 5)

While students having private tuition and not having private tuition were showed about same attitude towards science learning (Table 5).

Table 5. *Comparison of mean scores on attitude scale of students on gender, grade, locality and private tuition basis*

	AtSL scale		N	Mean	SD	t	Sig
Gender	Over All	Male	658	92.25	11.57	-8.445	0.000
		Female	575	97.52	10.13		
	Keenness to Learn science	Male	658	37.25	5.169	-8.148	0.000
		Female	575	39.57	4.24		
	Enjoyment in Science Learning	Male	658	21.71	2.97	-6.381	0.000
		Female	575	22.73	2.52		
	Disinterest	Male	658	12.71	4.62	5.018	0.000
		Female	575	11.38	4.27		
	Teacher Interaction	Male	658	17.29	2.51	-3.73	0.000
		Female	575	17.83	2.41		
Grade	Over All	8th	840	93.83	10.96	-4.024	0.000
		9th	393	96.58	11.57		
	Enjoyment in Science Learning	8th	840	21.88	2.89	-5.37	0.000
		9th	393	22.82	2.53		
	Disinterest	8th	840	12.51	4.61	4.76	0.000
		9th	393	11.17	4.12		
Locality	Over All	Rural	450	95.29	10.97	1.374	0.17
		Urban	783	94.37	11.37		
	Keenness to Learn science	Rural	399	39.24	4.17	4.651	0.000
		Urban	722	37.83	5.18		
	Enjoyment in Science Learning	Rural	428	22.44	2.51	2.338	0.02
		Urban	747	22.04	2.97		
Private Tuition	Over All	Yes	512	94.91	10.76	0.534	0.593
		No	721	94.56	11.560		

One way analysis of variance was used to find the mean differences among students' parental education and qualification of the respondents. The respondents with different paternal education did not differ significantly ($SS_{between\ groups}$= 386.105, F=2.398, p<0.05) in their attitude on overall *AtSL* scale but only differ significantly ($SS_{between\ groups}$= 386.105, F=2.398, p<0.05) in their attitude towards science learning on factor "Disinterest" of *AtSL* scale. While the respondents with different maternal education differ significantly in their attitude towards science learning for overall scale ($SS_{between\ groups}$= 3296.461, F=3.791, p<0.001); for the factors "keenness to learn science" ($SS_{between\ groups}$= 372.416, F=2.237, p<0.05), "Disinterest" ($SS_{between\ groups}$= 407.623, F=2.899, p<0.01), and "Teacher interaction" ($SS_{between\ groups}$= 115.445, F=2.701, p<0.01). Further analysis by Least Significant Difference (LSD) post hoc test for overall scale shows that higher education of mothers causes significantly difference in attitude towards science leaning among their offspring (Table 6). Similarly pattern of attitude among students was observed in three factors.

Table 6. *Least significant difference for mean differences among different maternal education*

Maternal Education	Maternal Education	Mean Difference	Sig
Illiterate	Secondary	-2.864	.003
	Higher Secondary	-5.713	.000
	Bachelor	-4.644	.042
Primary	Secondary	-2.902	.012
	Higher Secondary	-5.751	.001
	Bachelor	-4.682	.049
Elementary	Higher Secondary	-4.860	.005

The respondents with different paternal profession did not differ significantly ($SS_{between\ groups}$= 1362.305, F=1.806, p<0.05) in their attitude on overall *AtSL* scale. This difference in their attitude towards science learning was significant on factor "Keenness to learn science" of *AtSL* scale ($SS_{between\ groups}$=349.783, F=2.451, p<0.05). Whereas students with different maternal profession differ significantly in their attitude towards science learning ($SS_{between\ groups}$=9192.783, F=4.284, p<0.001). This difference in attitude towards science learning was found to be significant for factors "Keenness to learn science", and "Disinterest"**.** (Table 7)

Table 7. *Difference in attitude towards science learning of students caused by maternal profession*

			Sum of Squares	*df*	Mean Square	F	Sig
Maternal Education	Scale Total	Between Groups	3192.783	6	532.131	4.284	.000
		Within Groups	152270.522	1226	124.201		
		Total	155463.306	1232			
	Keenness to Learn Science	Between Groups	270.588	5	54.118	2.270	.046
		Within Groups	26576.598	1115	23.836		
		Total	26847.186	1120			
	Disinterest	Between Groups	310.327	6	51.721	2.566	.018
		Within Groups	23238.224	1153	20.155		
		Total	23548.551	1159			

The further details regarding attitude towards science learning were explored by applying Least Significant Difference (LSD) on maternal education as post hoc test (Table 8). The students whose mothers are household women have significantly higher attitude towards science learning than those students' mothers who are doing private job, but significantly lower than those who were doing personal business and Government job. Similarly those students whose mothers were private offices have significantly lower attitude towards science learning than those students' whose mothers were running their personal business and Government jobs. The students whose mothers were doing governmental jobs have significantly higher attitude towards science learning than those students whose mothers were working as labour.

Table 8. *One way ANOVA on maternal occupation*

Maternal Occupation	Maternal Occupation	Mean Difference	Sig
House hold women	Private job	8.28	.002
	Personal business	-6.07	.05
	Government Job	-4.07	.01
Private Job	Personal Business	-14.35	.000
	Government Job	-12.35	.000
Government Job	Labour	9.48	.011

The students with different numbers of brothers and sisters were not significantly different ($SS_{between\ groups}$=2071.781, F=1.092, p<0.05) in their attitude towards science learning on overall *AtSL* scale, and same pattern of attitude was observed in all factors of the scale.

DISCUSSION

In this study, the attitude towards science learning of female students was higher than male students. These findings contradicts those of previous research studies(Wooly (1978), Kuhn (1979), Haladyna and Thomson (1979), Lowery et al (1980), Atp and Wilkinson (1983), Menis (1983), Sjoberg (1983), Simpson and Oliver (1985), Banu (1986), Schibecia and Riley (1986), Breakwell and Beardsell (1992), Weinburgh (1995) and Parkinson et al (1998)) who had reported that male students have significantly higher attitude towards science than female students. On the other hand these findings are supported by Rana (2001). Overall female students are hardworking than the male students and results of Board of Intermediate and Secondary Education (BISE) of different years in Pakistan show that girls are higher achievers than boys at grade 10, grade11 and grade12, and majority of position holders are female students. Weinburgh (2000) has also reported that on some attitude factors, females have significantly higher attitude towards science than male students and Stables (1990) and Ye, et al. (1998) reported that male and female students do not significantly differ in their attitude towards science learning. One of the major reasons behind the findings of the present study might be that the research tools used in previous studies measure the "attitude towards science", whereas the research tool in this study measures "attitude towards science learning". Our approach required participants to consider their daily routines of studying, doing homework, their experiences in classroom activities and through discussion with teachers and class mates regarding science subject(s).

Urban schools students showed marginally better attitude than rural schools respondents, and same results are reported by Zacharia and Barton (2004). So school's locality does not seem to be the significant predictor of attitude towards science learning.

The attitude towards science learning of 9th grade (science students only) was higher than 8th grade students. This contradicts the findings of Ormerod and Duckworth (1975);

Brown (1976); Goodwin et al. (1981); Hoffman (1981) and Francis and Greer (1999) who found that student's attitude towards science decreases with increase in his/her grade. Hadden and Johnstone (1983) also reported a decline in attitude towards science at secondary school level, while Ye, et al (1998) reported that attitude has no direct relationship with change in grade level. In the Pakistani scenario, causes of this difference might be that after the 8th grade results those students that had a low attitude towards science did not continue with their studies in science subject(s). Many do leave the school system around this age. A second possible reason might be that only high academic achievers of 8th grade are allowed by their teacher or school to select science subjects, and low achievers are forced to select humanities to study at 9th grade. A third reason might be the lack of availability of professionally and academically qualified teachers in high schools and so the students recognise that they are receiving poor tuition in science and this affects their attitude towards the subject.

Maternal education plays significant role in students' attitude towards science learning. It is obvious from this study that increase in maternal education results in the higher attitude towards learning of their offspring. It indicates the importance of the maternal education, and this finding concurs with those of Schwirian and Thompson (1972) and Breakwell and Beardsell (1992) who were of the view that maternal encouragement had significant effect on students' attitude towards science as compared to paternal education. Banu (1986) found that parents' education did not affect students' attitude towards science. Interestingly there is no significant difference in the attitude towards science learning among students of illiterate mothers and maternal academic qualifications with graduate and post graduate. The possible reason might be in this study is that only a few of the maternal academic qualifications are higher that matriculation (Y10). Similarly maternal occupation also has significant difference in the attitude towards science learning among the respondents. Where the mother worked as government sector or doing their own personal business had significant positive effect on attitude towards learning on science compared to those families where the mother had private jobs or were doing physical work. The possible reason might be that mothers working in government sector usually have good educational background and it ultimately enhance students attitude. Homemakers possibly improved their children's attitude towards science because they usually have much time for their offspring and this could possibly lead to more discussion about their studies and the importance of science. It would be useful to follow up this research with interviews or focus groups of mothers to unpick how their occupation affects the way that their children perceive science learning.

In Pakistan, even at school level, private tuition is common practice and especially for science students at grade 9. The findings from this study conclude that even though over a third of participants received private tuition this had no significant effect on students' attitude towards science learning. The major reason is that at tutors at private tuition prefer to teach selective topics and their trend is to "teach to test" rather than to develop intellectual or conceptual development among students, and hence this may not contribute to improving students' attitude towards science learning.

CONCLUSION

The focus of this study was to develop a standardized attitude scale in local educational context, and analyze the relationship of demographic variables, like gender, parental education and occupation, family size, and private tuition with attitude towards science learning among students of government schools. The findings, based on the standardized questionnaire, enrich the understanding of attitudes to science learning in the Pakistani context and indicate that female students have better attitudes than male and that maternal

occupation and grade change have significant effects on science learning attitudes. The students of 9^{th} grade have better attitude than students of 8^{th} grade, and rural school students have marginally better attitude than urban school students and this difference was not significant. At the same time, we were able to show that paternal education and qualification, family size and private tuition did not affect science learning attitude. These findings had provided evidences regarding the factors influencing the attitude of students towards science learning in Pakistani perspective.

SUGGESTIONS

There is need of in-depth study of female students' attitude towards science learning in Pakistani scenario. The results of that study can be used to explore different techniques for developing male students' attitude towards science learning and ultimately enhancing their achievement in the science subject like the intervention in attitude towards science by Kelly (1986).

It was clear from the study that there was need for professional development to support teachers in developing students' attitude towards science. This is not a easy task since it requires better understanding of those factors that influence attitude. Thos is still at an early stage as this study demonstrates.

Underdeveloped and developing countries has the problem of low maternal educational and their low jobs profiles that ultimately effect students' attitude towards science learning, so the role of school and teachers becomes very important in this scenario, and it is important to focus on school and teacher's role in developing attitude towards science learning among students.

This study indicated that private study did not improve students' attitude towards science learning. Our advice would be that private tuition, especially in government sector and particularly in private sector, should be discouraged. It not only causes economical burden on parents but it also only promotes rote memorization.

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