Relationship of Students' Attitude towards Science with Their Self-Concept: A Gender and Socioeconomic Status (SES) Based Study

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Abstract: *This study gauges the relationship of students' self-concept with respect to their attitude towards science. The randomly selected sample consisted of 1966, 10th grade science students. The science-related attitude was measured through an adapted version of TOSRA (r= 0.89). For Self-Concept, a questionnaire developed by Rana (2002) having r = 0.87 was used. For SES family income, parents' education and nature of job were considered. Pearson r along with descriptive statistics and t-tests was used for data analysis. Analysis revealed all respondents had a positive self-concept and attitude towards science. Respondents' self-concept on the basis of gender as well as among three levels of SES was not significantly different. A moderate, positive and significant correlation was found between both variables. A similar pattern was seen in the case of male, female, low-level SES and medium-level SES respondents separately, but the relationship was weak though positive and significant for respondents of high-level SES.*

Key Words: Attitude towards Science, Self-Concept, Gender, Socioeconomic Status

Introduction

Development of a democratic social set-up via a change in the outlook of its population has been totally dependent on science (American Association for the Advancement of Science, 1990; Rudolph & Horibe, 2015) which is crucially needed in developing countries with fewer science-skilled men power (Tobin & Fraser, 1988). According to Bauer and Falade (2014) and, National Science Board (2016) research regarding attitudes towards and self-concept has enthused increasing interest among researchers. Theoretical applications of the self-concept theory to education derived prominently from the work of Snygg and Combs (1950) and Rogers (1951), Snygg and Combs (1950) suggested that all behaviours of individuals are related to the perception of self. Kennedy and Taylor, (2016) are of the view that

attitude has been a multidimensional construct for a half-century which is termed as attitude towards science (Yara, 2009).

Different studies have shown notable differences in the relationship between gender with self-concept. Researchers (Pehlivan 2010, Karasakaloglu et al.; 2009) explored that self-concept and environmental factors including the education of the parents related to their financial level and gender had been significantly correlated. Wang and Berlin (2010) conducted research in Taiwan on elementary school students and found that attitude and self-concept in science showed a significant relationship but there were no gender differences. Unlikely, Bara and Maskan (2011) found that boys showed higher self-concept as compared to girls. Likewise, other Researchers (Çakir, Sahin & Sahin, 2000) found that gender did not affect the self-

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concept of science students. Among secondary-level science students, Wan and Lee (2017) in Hong Kong found that the relationship between attitude and self-concept was strong for boys with respect to girls. Afuwape (2011) found no significant differences in gender base among basic science students. According to Weinburg (2000), during gender basis comparison male students' enjoyed science, and were more motivated thus showing a higher self-concept in science which was more interested in the perception of their teachers and the value of science.

Parents' socioeconomic status was found another variable which affects the students' attitudes. Hu et al. (2018) found that students' attitude towards science was significantly correlated with family socioeconomic status, gender and attitude to school. Students with different levels of SES showed different scores on the socio-economic scale. Hu et al. (2018) and Hu, Leung & Teng (2018) concluded that the attitudes of Hong Kong secondary school students were significantly affected by parental socioeconomic level. Students having high socioeconomic status showed the highest mean scores on the attitude scale (Telli, Brok, & Cakiroglu, 2010).

Baldwin and Hoffman (2002) are of the view that self-concept is a variable with which an individual evaluates himself or herself and it is positively or negatively influenced by an individual's age, gender, and socio-economic status. Sometimes variations were found in the results of the same study. By taking an academic self-concept and the father's educational background as variables, different researchers (Senler & Sungur, 2009) noticed differences at the beginning and end of the study, at the beginning of the research positive and significant correlation was noted but at the end, a negative relationship was found between the variables. According to researchers (Çakir et al. 2000), students' self-concept and socioeconomic level had no significant relationship.

Research Problem

During the Literature review, it was found that a rare number of studies i.e., Rana, (2002) in Pakistan) had focused on the relationship between variables like science-related attitudes and the self-concept of secondary-grade students in Pakistan on socioeconomic and gender bases. This enabled the researcher to fill the gap between assumptions and reality.

Objectives

This research was based on,

- To find out the relationship of students' attitudes toward science with their self-concept on the basis of their gender and socioeconomic status.

Research Questions

- Does there exist any relationship between science students' self-concept and attitude towards science on a gender basis?
- Does there exist any relationship between science students' self-concept and attitude towards science on an SES basis?

Method

The population of this research consisted of 10th graders who opted for science from all the public secondary schools of Punjab (Pakistan). Using a multistage sampling technique, among 36 districts of Punjab, four districts (Kasur, Lahore, Okara and Pakpatan) were randomly selected on the basis of their literacy rates. Schools among the four selected districts were divided into 2 strata on a gender basis. In this way, 16 schools were randomly selected from each district (8 male and 8 female schools). One section (in case of more than one section) of tenth-grade science students was taken randomly for the sample. The logic behind the selection of a sample from this grade was that students have a clear state of mind and can respond at their best on an attitude scale.

Research Tools

A brief description of tools through which data was collected has been given as

TOSRA

Science-related attitude has been gauged by Fraser's (1981) famous tool known as the "Test of Science-Related Attitude". This research adapted its translated version (Urdu). It aimed to find the attitudes of science students from 7-12 grades (2002, 2002). It was cross-validated in different contexts. Across contexts, its reliability values were 0.83-0.96. In the Pakistani context, Rana (2002) used it in translated form with a reliability coefficient of 0.93. Rana (2002) used it to explore the attitudes of science students belonging to 11-12 grades. Answer (2012) used it with 52 items

having r= 0.89 value, to find science students' attitudes across grades (9-10) during his doctoral study.

Self-Concept Questionnaire

The Self-Concept questionnaire consisted of a 105-item, 5-point Likert instrument, which measures students' self-concept developed by Rana (2002) in the Pakistani context. Rana (2002) used this scale in his doctoral study with a reliability value of 0.94.

Socioeconomic Status (SES)

For the measurement of SES Rana (2002) considered the following indicators, education of parents, income level of the family, house ownership, availability of home servants and transport to attend educational institutions and other facilities like computers, TV, AC, telephone and internet. However in the present study, after the consultation with experts, parental education, occupation and family income (Gray & Aulad, 2000) were used as indicators for the calculation of SES. After the computation of total scores on SPSS, the SES was classified into three categories i.e. higher, medium and low levels.

Analysis and Results

Table 1

Mean and SD of Attitude towards Science and Self-concept

Variable	All	Male	Female	Low SES	Med SES	High SES
N	1966	997	969	828	561	577
Attitude towards Science						
Mean	189.29	185.20	193.49	188.98	190.47	188.59
SD	20.45	21.60	18.27	22.44	19.25	18.50
Self-Concept						
Mean	393.63	387.25	400.20	391.80	394.38	395.54
SD	46.04	48.98	41.82	50.21	43.02	42.46

The above table reflects the Mean and SD of the variables. For attitude toward science, Mean and SD for all respondents were (189.29, 20.45) for male (185.20, 21.60), for female (193.49, 18.27), for Low SES (188.98, 22.44), for Med SES (190.47, 19.25) and for Hi SES was (188.59, 18.50).

In the case of Self-Concept Scale mean and SD for all respondents was (393.63, 46.04) for male (387.25, 48.98), for female (400.20, 41.82), for Low SES (391.80, 50.21), for Med SES (394.38, 43.02) and for High SES was (395.54, 42.46).

T-Test

Table 2

Gender basis Comparison of students' self-concept

Gender	N	Mean	SD	df	t	p	Effect size
Male	997	387.25	48.977	1964	-6.294	0.000	0.28
Female	969	400.20	41.820				

*p<0.00

It is clear from the table that the t value (-6.294) with df (1964) was significant at p<0.00. The value of effect size was 0.28 which is more than 0.2 which is not negligible (Cohen, 1988) thus leading to the conclusion that males and females differ in their self-concept. Females have a higher level of self-concept as compared to males.

Table 3

Gender basis comparison of students' Attitude towards Science

Gender	N	Mean	SD	df	t	p	Effect size
Male	997	185.05	21.607	1964	-9.170	0.000	0.42
Female	969	193.49	18.271				

*p<0.00

This table reflects that the t value (-9.170) with df (1964) was significant at p<0.00. The value of the effect size was 0.42. Hence it can be concluded that female respondents have a significantly higher level of attitude towards science as compared to male respondents.

Correlation Analysis

Table 4

Correlation of Students' Attitude toward Science with their Self-Concept

Respondents	N	r
Overall	1966	0.480**
Male	997	0.474**
Female	969	0.453**
Low SES	828	0.548**
Medium SES	561	0.480**
High SES	577	0.342**

**Significant at the 0.01 level (2-tailed)

The Relationship between Students' Attitudes toward Science with their Self-Concept was analyzed and a correlation coefficient of 0.480** was found. It showed that a positive and significant relationship at p<0.01 exists between Students' Attitudes toward Science and their Self-Concept.

For male and female respondents correlation coefficients of (0.474** and 0.453**) respectively were calculated which showed that there exists a positive and significant at p<0.01 relationship between Attitude toward Science and their Self-Concept.

In the case of levels of SES, a higher magnitude of correlation coefficient (0.548**) was measured for low levels of SES as compared to the magnitude of correlation coefficient of medium level (0.480**) and higher level of SES (0.342**).

Table 5

Relationship of Students' Attitude toward Science with their Self-Concept across SES levels and Gender

		Male		Female
SES	N	r	N	r
Low SES	510	0.497**	318	0.632**
Med SES	296	0.441**	265	0.519**
High SES	192	0. 439**	386	0.215**

**Correlation is significant at the 0.01 level (2-tailed)

The correlation of Students' Attitude toward Science with their Self-Concept across SES and Gender was analyzed and the correlation coefficients for male and female respondents were (r = 0.430**, 0.632**), positive and significant at p<0.01 for low-level SES. It is evident that the relationship is higher for female respondents.

For medium-level SES the correlation coefficients for male and female respondents were (r = 0.441**, 0.519**), positive and significant at p<0.01

In the case of high-level SES, the correlation coefficients for male and female respondents (r = 0. 439**, 0.215) at p<0.01 were measured respectively.

It is evident that the relationship is very weak for female respondents.

Conclusion

- All the science respondents have positive attitudes and self-concepts.
- At the gender level, a significant difference was found between respondents' self-concept and attitude towards science, as it was higher for females as compared to males.
- Among the three levels of SES, the self-concept scores of all the respondents were significantly different.
- The correlation of science students' attitudes with their self-concept was moderate, positive and significant for all respondents. The same pattern was seen in the case of male, female, low-level SES and medium-level SES respondents separately. However, the relationship was weak though positive and significant for respondents of high level SES.
- On the basis of SES levels across genders, the relationship of attitude toward science with self-concept was moderate, positive and significant for all categories of respondents except strong, positive and significant for females of low-level SES and was weak, positive and significant for females of high-level SES.

Discussion

The study revealed that students have positive attitudes toward science and Self-Concept. Another part of this finding was the positive self-concept of science students. This was similar to the findings of Rani (2006), Rana (2002), and Weinburg (2000). At the subject level, it was supported by other researchers as Pehlivan and Koseoglu (2010) found a positive self-concept of students in biology, Yilmaz (2006) concluded positive self-concept of students in Mathematics, Afuwape (2011) found a positive self-concept of students in basic science and positive self-concept of students was also found by (Fan, 2001), Ayaz, Khan and Khan (2016). It was a key finding in the sense that a person having a positive self-concept should have confidence in him and might be able to get a higher status in society. It is a self-evaluation of oneself by which someone thinks what he can do and what he can think and he has the potential to do something consequently he could be able to get a high

standard within the society by thinking positively about himself.

In this study, the researcher found that gender had an effect on the attitude and self-concept of science students. In the case of science students' self-concept, it was found that on the basis of gender, there was a significant difference between respondents' self-concept and contradictory results were noted by Afuwape (2011) that the self-concept of male and female students was not significantly different from one another. Weinberg (2000) found that females were more positive in the perception of their science teachers and the value of science but male students were more self-motivated had a better self-concept and showed more positive attitudes towards science and enjoyment of science as compared to the female students. Another finding of this study was that the self-concept scores of respondents were not significantly different among the three levels of SES. These findings were in contraction with Trowbridge, (1972) who found that students belonging to low levels of SES have higher scores on the self-concept scale as compared to the average level SES students showing no difference in age, race, gender and locale. The present study also reflected that the relationship between students' attitudes toward science with their self-concept was moderate, positive and significant for all respondents. It was similar to the findings of Rani, (2000) who found a strong relationship between self-concept and attitude towards science. As indicated by Rani (2000) significant variable that influences students' attitude toward science is their science self-concept.

The relationship between students' attitudes toward science with their self-concept was moderate, positive and significant for male, female, low-level SES and medium-level SES respondents separately. However, the relationship was weak though positive and significant for respondents of high level SES. On the basis of SES levels across genders, the relationship of attitude toward science with self-concept was moderate, positive and significant for all categories of respondents except strong, positive and significant for females of low-level SES and was weak, positive and significant for females of high-level SES.

The results of other research in comparison to the present study were quite interesting as Weinberg (2000) showed different results in which the self-concept of female students was low/ less positive while the self-concept of male students was more positive. Another researcher (Afuwape,

2011) while studying the self-concept of basic science students revealed that students do not differ in their self-concept at a general level. Edowsomwan (2015), in correlational research about science students' socioeconomic status and attitude towards computer science, explored the significant relationship between the two variables. Rana (2002) in the Pakistani context concluded similar findings that parents' socioeconomic status, self-concept of science students and gender had a significant positive correlation with attitudes. Moreover, on the basis of SES levels across genders, the correlation of attitude and self-concept was strong, positive and significant for females of low-level SES and was weak, positive and significant for females of high-level SES which was in contrast with Edosomwan

(2015) finding that students of families with moderate income levels had higher scores than those from low-income families. Turkman (1999) revealed that students with low socioeconomic status showed low mean scores on the attitude scale and vice versa. Orhun and Orhun (2001) found that students' attitude was affected by family socioeconomic status in this society. In this study, the socio-economic status of the students was moderate with respect to attitude gender level and income level variables and also with student self-concept. A student's self-concept is significantly related to the financial status of a family (Fan, 2001). Ayaz, Khan and Khan (2016) found that socioeconomic status had a significant relationship with the students' self-concept.

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