

Study of Science Process Skills and Academic Achievement among Secondary School Students

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ABSTRACT

The science processes are the integral part of the teaching of science. Science as a discipline evolves because of these process skills namely interpretation of data, identifying the variables, hypotheses formation, designing experimental designs, data analysis etc. The science processes if taught over a period of time and mastered by the students lead to the development of scientific attitude among them. Scientific attitude helps the students in becoming methodological and systematic in their approaches. The rationale behind the present descriptive study was to explore how do science process skills support the students in becoming an organized personality and hence ensuring a reliable academic performance? The review of related literature revealed mixed findings with respect to the variables under consideration and hence null hypotheses were framed for the concerned objectives. As sample, 336 class IX students of three Government senior secondary school in Delhi were randomly selected. For data collection, a standardized tool that is Test of Science Processes (K.S. Misra, 2012) was administered on the students. The Mid-term examination marks were used for the variable academic achievement. Data had moderate skewness and hence parametric tests could be employed for statistical analysis. The data analysis comprised t-test and Karl Pearson's coefficient of correlation. It showed that there were gender differences, in the favor of boy students, with respect to science process skills as well as academic achievement scores. The science process skills and academic achievement were significantly and positively correlated to each other. The study had educational implications for teachers, students and the parents.

Keywords - Science, Scientific Attitude, Science Process Skills, Academic Achievement.

I. INTRODUCTION

In schools, science curriculum focuses upon the science process skills as essential tools that support the students to construct knowledge (Ongowo, 2017). For the students to comprehend the science concepts, laws, principles, theory etc. it becomes essential to develop an ability to link the constructed knowledge and developed skills. Science process skills nurture the critical thinking as by nature they are investigative and cognitive (Ostlund, 1992). The science processes are the integral part of the teaching of science. Science as a discipline evolves because of these process skills namely collection transformation and interpretation of data, identifying the variables, defining the variables, describing the relationship between the variables, hypotheses formation, designing experimental designs, data analysis, drawing the conclusions, generalization etc. Science process skills simplify the learning of science, motivate the students, foster a sense of responsibility among them with respect to learning, enhance the permanency of learning etc. (Carey et al, 1989). The science processes if taught over a period of time and mastered by the students lead to the development of scientific attitude among them. Scientific attitude helps the students in becoming methodological and systematic in their approaches. In teaching and learning situations, academic achievement is generally measured by continuous assessment or examinations. The outcome of education is academic achievement (Mimrot, 2016). In school scenario, the learning on the part of the students is directly related to academic achievement (Nisar et al, 2017) as a quality school environment is linked with academic achievement (Hattie, 2009). Methodologically, the teachers must exercise the efforts to improve the academic performance of students by systematically

conducting activities, sequentially organizing activities so that students are able to sense the meaning of the task performed. The rationale behind the present descriptive study was to explore how do science process skills support the students in becoming an organized personality and hence ensuring a reliable academic performance that is reflected as academic achievement.

II. LITERATURE REVIEW

In the domain of science process skills, the review of related literature showed mixed findings as some studies have reported that the girl students had significantly higher scores than boy students (Raj & Devi, 2014 and Zeidan & Jayosi, 2015) while some other studies have reported reverse trend that is boy students had significantly better science process skills (Ongowo, 2017). Also, no significant difference between boy and girl students on science process skills has been found (Ong et al, 2015). Regarding the locale, urban students had better performance than rural students in the dimensions of science process skills namely classification, inference, observation, and communication (Ong et al, 2015 and Ongowo, 2017). The rural students had significantly better mean scores, than urban students, on the measurement dimension of science process skills (Raj & Devi, 2014 and Zeidan & Jayosi, 2015). The studies have shown that the science process skills have low positive (Raj & Devi, 2014) and significantly positive correlation with achievement in science (Feyzioglu, 2009), formal thinking abilities (Brotherton & Preece, 1995) and laboratory use (Feyzioglu, 2009 and Sukarno et al, 2013). Peer assisted techniques and school related activities supported the students in significantly improving their academic achievement (Ng et al, 2016 and Sa-ngiamjit, 2016) as

well as science process skills (Sa-ngiamjit, 2016). In the area of academic achievement, the literature reviewed shows that at higher secondary school level, boy and girl students significantly don't differ in academic achievement (Dhall,2014; Jennabadi et al, 2015 and Goel,2015) but some studies have reported the findings in the favor of boy(Nadeem & Ahmad, 2016) and girl students (Mimrot, 2016) also. There are mixed findings between academic achievement & academic achievement motivation (Broussard & Garrison,2014 and Dhall,2014) and mental health (Jogson & Doshi,2014 and Ahuja, 2016). At secondary school level, The students of private schools have better academic achievement in comparison to the students of government schools (Mimrot, 2016). Studies have explored that the academic achievement is not significantly correlated with emotional intelligence (Yilmaz, 2007) but some other studies reported a significant positive correlation with emotional intelligence (Jennabadi et al, 2015 and Prabha, 2015), socio economic status, study habits, school climate (Nisar et al, 2017). Studies have also shown that the academic achievement has significantly positive correlation (Vaishnav & Chirayu, 2013 and Nzesei, 2015) and no correlation (Gappi, 2013) with learning styles. Dimensions of home environment like control, reward, protectiveness, social isolation and conformity are significantly positively correlated with academic achievement. (Mimrot, 2016). Students at secondary school level with respect to differential ordinal positions at birth and differently sized families significantly differ in their academic achievement (Sangtam, 2014).

III. RESEARCH METHODOLOGY

This study explored the following objectives

- To study science process skills among boys and girls at secondary school level
- To study academic achievement among boys and girls at secondary school
- To study correlation between academic achievement and science process skills at secondary school level

3.1 Hypotheses

Literature review showed mixed finding with respect to the variables under consideration so the null hypotheses were framed for the concerned objectives:

H₀₁: The boys and girl students at secondary school level do not differ significantly with respect to science process skills.

H₀₂: The boys and girl students at secondary school level do not differ significantly with respect to academic achievement.

H₀₃: There is no significant correlation between academic achievement and science process skills at secondary school level.

3.1 Delimitation

This study had delimitation with respect to the level at which it was conducted that is secondary school level.

IV. METHODOLOGY

4.1 Research Design And Sample

Descriptive survey research design was used to test the hypotheses. One district in Directorate of Education, Delhi was randomly selected. In the selected district three schools were further selected by random sampling. From these three schools, 170 boys and 166 girls of ninth standard were randomly selected. On this sample standardized tool was administered and their mid-term marks were used as their academic achievement.

4.2 Variables

The present study had following variables

Independent variable: In this study gender was the independent variable. It had two levels : boys and girls.

Dependent variable: In this study, science process skills and academic achievement were the dependent variables.

Intervening variables: At secondary school level fatigue, family background, previous achievement, motivational levels etc. were assumed to be uniformly present amongst the students.

4.3 Tools

In the present study, following tools were administered for the collection of data

(i) Test of Science Processes (2012) by K.S. Misra: The scale consists of 18 items in four domains that is (1) ability to draw inferences and exclude variables, (2) design experiment, (3) interpret data and (4) identify supporting data. The test-retest reliability coefficient of this test is 0.783 which is significant at 0.01 level of significance. Predictive and face validity is 0.1913 for girls and 0.3381 for boys respectively. These values stand significant at 0.01 level of significance.

(2) Academic achievement: Mid-term examination marks of these students were used to measure their academic achievement. This examination is conducted by the Directorate of Education, Delhi in all Government schools under its jurisdiction.

4.3 Procedure

The standardized tool was administered. The skewness of science process skills and academic achievement of boys and girls were calculated. It was 0.271 for science process skills and 0.326 for academic achievement. These skewness values indicate that this sample has moderate skewness and hence parametric tests like t-test and Karl Pearson's product moment coefficient of correlation can be applied for the analysis of data.

4.3 Data Analysis

H₀₁: The boys and girl students at secondary school level do not differ significantly with respect to science process skills.

The table 1 shows that the t value 7.98 is significant at .01 levels of significance and it is in the favor of boy students so the H₀₁ is rejected. This finding does not support the research work of Raj & Devi (2014) and Zeidan & Jayosi (2015) who reported the results in the favor of girl students. But this finding is in consonance with Ongowo (2017) in which the significantly better performance of the boy students on science process skills was reported.

Students	N	Mean	Stand ard Devia tion	Standar d Error of Differ ence betwe n the Means	Diffe rence betw een the Mea ns	t-value
Boys	170	19.87	7.54	0.73	5.83	7.98 [#]
Girls	166	14.04	5.87			

.01 level of significance* .05 level of significance

Table 1: t-test for science process skills of students at secondary school level

H₀₂: The boys and girl students at secondary school level do not differ significantly with respect to academic achievement.

The table 2 shows that the t value 4.47 is significant at .01 level of significance and it is in the favor of boy students, in comparison to girl students so the H₀₂ is rejected. The finding supports the study by Nadeem & Ahmad (2016). This finding does not support the research work by Mimrot (2016) who reported the similar results in the favor of girl students.

Students	N	Mean	Stand ard Devia tion	Standard Error of Differenc e between the Means	Difference between the Means	t-value
Boys	170	58.92	15.82	1.52	6.76	4.47 [#]
Girls	166	52.16	11.85			

Table 2: t-test for academic achievement of students at secondary school level

H₀₃: There is no significant correlation between academic achievement and science process skills at secondary school level.

Table 3 shows that the t value 6.08, coefficient of correlation is significant at 0.01 level so H₀₄ is not accepted but is rejected.

r value	t value
0.316	6.08 [#]

Table 3: Coefficient of correlation between the science process skills and academic achievement

V. RESULTS

This study shows the significantly better mean scores of boy students, in comparison to girl students, with respect to science process skills and academic achievement at secondary school. The study also reports that the dependent variables namely academic achievement and science process skills are positively correlated.

VI. CONCLUSION

There may be some plausible reasons for the above findings like the quality teaching practices that motivate the students to think, reflect and probe the processes and phenomena. Sincere efforts by the resourceful teachers encourage the students to be methodological. Organized study habits with focus on deriving meaningfulness and comprehension might enabled them to score well in academic subjects. As implications for teachers it is suggested that they may arrange the teaching-learning situations in such a manner that requires the students to

think rather than retrieve. Science as a discipline should be taught by observations and experimentation so that the students learn its nature and hence develop a spirit for learning science. For the students it is suggested that they may be required to ask themselves what, why and how pertaining to any given aspect under consideration. They may undergo discussion or deliberation among themselves also to derive some logical conclusion. Parents at home may have a keen eye on the habits, life style of their wards that is the student may be motivated to be organized and systematic in approach towards day to day matter. Tendency of being haphazard, random, guessing etc. among the students should be minimized.

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