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SCIENCE PROCESS SKILLS AND ACHIEVEMENT IN SCIENCE AMONG HIGH SCHOOL STUDENTS

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Abstract

The main objective of this investigation is to find out the level of acquisition of Science Process Skills and whether there is any significant difference exists in the dimensions of Science Process Skills of high school students with respect to few personal variables. For the purpose of this investigation the researcher has followed normative survey method. Sample consists of 1000 IXth standard students distributed evenly from5 districts of Tamil Nadu (includes boys [466] and girls [534] both Tamil and English medium students) from government, government aided and private schools. Samples were selected using random sampling techniques. The Science Process Skills Inventory was constructed and validated by the researcher used for this investigation. Collected data were analyzed using appropriate statistical techniques. The major findings of the research show that there is very low positive correlation (0.230) between the science process skills and achievement in science among high school students.

Key Words: *Science Process Skills, Scientific inquiry, Achievement in Science*

Introduction: Science Process Skills (SPS) are defined as transferable skills that are applicable to many sciences and that reflect the behaviors of scientists. They are the skills that facilitate learning in physical sciences, ensure active student participation, have students develop the sense of undertaking responsibility in their own learning, increase the permanence of learning, and also have students acquire research ways and methods, that is, they ensure thinking and behaving like a scientist. For this reason, it is an important method in teaching science lessons. SPS are the building-blocks of critical thinking and inquiry in science (Ostlund, 1992).

Science Process Skills are based on scientific inquiry and teaching science by inquiry involves teaching students science process skills, critical thinking, scientific reasoning skills used by scientists (Pratt & Hackett, 1998) and inquiry is defined as an approach to teaching, the acts scientists use in doing science and it can be a highly effective teaching method that helps students for understanding of concepts and use of process skills (Yager & Akçay, 2010).

Science Process Skills are essential for teaching science content knowledge and scientific inquiry because teachers who have a poor understanding of the science process skills are less likely to have a positive attitude towards them and are, therefore, less likely to teach them to their students (Cain, 2002). Science Process Skills instruction also promotes positive attitudes toward science among students; thus, the avoidance of teaching the process skills can be detrimental (Bilgin, 2006). Many researches stated that teachers who are deficient in the science process skills are less equipped to use inquiry in their classrooms (Aka et al., 2010; Lotter et al., 2007; Marshall et al., 2009). Similarly, teachers who are not familiar with science processes or have low interest in science processes are not likely to teach science by inquiry. Teachers' competence in the science process skills has also been found to promote a positive attitude towards science (Bilgin, 2006).

Science Process Skills are in two categories which are basic and integrated skills. Basic process skills include observing, inferring, measuring, communicating, classifying, predicting, using time space relations and using numbers. Integrated process skills include controlling variables, defining operationally, formulating hypotheses, formulating models, interpreting data and experimenting,).

Objectives of the study: 1. To find out the level of acquisition of Science Process Skills among high school students. 2. To find out whether there is any significant differences exist in the dimensions of Science Process Skills of high school students with respect to the following personal variables. 3. 1. Gender 2. Locality 3. Medium of instruction 4. Type of management

To find out the relationship between Science Process Skills and Achievement in Science among high school students.

Hypotheses of the study: The following hypotheses were formulated based on the objectives of the study. 1. There is no significant difference in Science Process Skills of IXth standard students based on Gender, Locality, Medium of instruction, and Type of management with respect to the following dimensions: (i) Measuring, (ii) Observing, (iii) Classifying, (iv) Inferring, (v)

Predicting and (vi) Communicating. 2. There is no relationship between Science Process Skills and Achievement in Science of high school students.

Research Method: For the purpose of investigation the researcher has followed the normative survey method.

Sample and Sampling technique: Sample consists of 1000 IXth standard students distributed evenly from five districts of Tamil Nadu (includes boys [466] and girls [534] of both Tamil and English medium students) from government, government aided and private schools. Samples were selected using random sampling technique.

Description of the tool: The Science Process Skills inventory was constructed and validated by the investigator used for this investigation. The tool was framed using six dimensions (Measuring, Observing, Classifying, Inferring, Predicting and Communicating) with 51 multiple choice questions and 4 options for each statement. Each right question carries one mark, for wrong and omitted questions no mark is given.

Statistical analysis of data: Mean, Standard deviation, T- test, ANOVA and Correlation coefficient are statistical methods were applied to analyses and interpretation of the scores on collected data on each dimension of science process skills.

TABLE – 1: Level of Science Process Skills of High School Students

S. No.	Variable	Category	Marks	Frequency	Percentage
1	Science Process Skills	Low	0-15	167	16
		Average	16-35	730	73
		High	36-51	103	11

Results of the above table shows that the level of science process skills is average in nature.

TABLE – 2: Mean scores of Science Process Skills of High School Students

Dimensions of Science Process Skill	N	Mean value
Measuring	1000	46.44
Observing	1000	41.77
Classifying	1000	53.85
Inferring	1000	43.5
Predicting	1000	38.77
Communicating	1000	64.53
Total	1000	49.64

It is observed from the above table the various dimensions of science process skills the mean scores of communicating skill is higher than the rest of other dimension.

Testing of Hypotheses: 1. There is no significant difference in science process skills of IXth standard students based on Gender, Locality, Medium of instruction, and Type of management with respect to the following dimensions: (i) Measuring, (ii) Observing, (iii) Classifying, (iv) Inferring, (v) Predicting and (vi) Communicating. 2. There is no relationship between science process skills and achievement in science of high school students.

TABLE -3: Comparison of Mean Scores: Gender wise Analysis of Science Process Skills

Dimensions of Science Process Skill	Gender	N	Mean	S.D.	t-test
Measuring	Male Female	466 534	45.79 47.00	18.28 19.93	1.00
Observing	Male Female	466 534	40.40 42.96	19.48 19.63	2.06*
Classifying	Male Female	466 534	52.98 54.60	22.26 24.24	1.09
Inferring	Male Female	466 534	42.86 44.06	18.12 19.38	1.01
Predicting	Male Female	466 534	37.16 40.17	24.67 22.93	1.90
Communicating	Male Female	466 534	64.12 64.89	26.16 26.28	0.46
Total	Male Female	466 534	48.78 50.39	15.83 17.28	1.52

**denotes significance at 0.05 level*

From the above table, it is inferred that the calculated‘t’ value is found to be 2.06, which is greater than the table value. Hence, there is a significant difference in the dimension (observing) of science process skills. It shows that the male and female students differ significantly with respect to the observing skill. Hence, the null hypothesis is partially accepted.

TABLE – 4: Comparison of Mean Scores: Locality wise Analysis of Science Process Skills

Dimensions of Science Process Skill	Locality	N	Mean	S.D.	t-test
Measuring	Rural Urban	494 506	44.50 48.34	18.51 19.64	3.19**
Observing	Rural Urban	494 506	42.02 41.53	19.44 19.74	0.39
Classifying	Rural Urban	494 506	52.60 55.07	22.90 23.72	1.68
Inferring	Rural Urban	494 506	43.03 43.96	19.68 17.91	0.78
Predicting	Rural Urban	494 506	37.65 39.86	23.00 24.51	1.47
Communicating	Rural Urban	494 506	64.40 64.66	25.93 26.51	0.16
Total	Rural Urban	494 506	48.80 50.46	16.44 16.79	1.58

***denotes significance at 0.01 level*

From the above table, it is inferred that the calculated‘t’ value is found to be 3.19, which is greater than the table value. Hence there is a significant difference in the dimension (measuring) of science process skills. It shows that the urban and rural students differ significantly with respect to measuring skill. Hence the null hypothesis is partially accepted.

TABLE – 5: Comparison of Mean Scores: Medium of instruction wise Analysis of Science Process Skills

Dimensions of Science Process Skill	Medium of Instruction	N	Mean	S.D.	t-test
Measuring	Tamil English	601 399	45.54 47.80	18.04 20.72	1.82
Observing	Tamil English	601 399	41.19 42.64	19.41 19.84	1.15
Classifying	Tamil English	601 399	52.96 55.18	22.46 24.58	1.48
Inferring	Tamil English	601 399	41.07 47.15	16.63 21.17	5.07**

Predicting	Tamil English	601 399	37.96 39.97	22.72 25.31	1.31
Communicating	Tamil English	601 399	61.95 68.42	25.57 26.73	3.85**
Total	Tamil English	601 399	48.26 51.72	15.57 17.93	3.24**

*** denotes significance at 0.01 level*

From the above table, it is inferred that the calculated 't' value is found to be 5.07 (Inferring skill), 3.85(Communicating skill) and 3.24 (total) which is greater than the table value. Hence there is a significant difference in the dimension of (inferring, communicating and total scores) science process skills. It shows that the Tamil and English medium students differ significantly with respect to inferring and communicating skills and total science process skills. The rest of them are not differing significantly. Hence the null hypothesis is partially accepted.

TABLE – 6: Comparison of Mean Scores: Type of Management wise Analysis of Science Process Skills

Dimensions of Science Process Skill	**Source of variation**	**Df**	**Sum of squares**	**Mean of squares**	**F - ratio**
Measuring	Between groups	2	92.56	46.28	0.13
	Within groups	997	366254.63	367.36	
	Total	999	366347.19		
Observing	Between groups	2	1175.62	587.81	1.53
	Within groups	997	382662.05	383.81	
	Total	999	383837.67		
Classifying	Between groups	2	4646.01	2323.00	4.30*
	Within groups	997	538716.92	540.34	
	Total	999	543362.93		
Inferring	Between groups	2	9160.78	4580.39	13.29**
	Within groups	997	343641.92	344.68	
	Total	999	352802.70		
Predicting	Between groups	2	3129.19	1564.60	2.77
	Within groups	997	562761.83	564.46	
	Total	999	565891.02		
Communicating	Between groups	2	15411.68	7705.84	11.44**
	Within groups	997	671438.48	673.46	
	Total	999	686850.16		

Total	Between groups	2	3725.64	1862.82	6.80**
	Within groups	997	273099.11	273.92	
	Total	999	276824.75		

**denotes significance at 0.05 level, **denotes significance at 0.01 level*

From the above table, it is inferred that the dimensions of (inferring skill, communicating skill, classifying skill and total scores) science process skills with respect to type of management, the calculated 'F' ratio is greater than the table value. Hence there is a significant difference between Government, Govt. Aided and Matriculation school students.

TABLE – 7: Comparison of the relationship between Science Process Skills and Achievement in Science of High School Students

Variable	**N**	**R value**	**Level of Significance**
Science process skills	1000	0.230	Not significant
Achievement in science	1000		

The result of the above table shows that there is no significant; there is a very low positive correlation found between science process skills and achievement in science of high school students.

Major finding of the study

1. In accordance with science process skills, the level of communicating skills is high in nature than the other dimensions (viz: Observing, Measuring, Classifying, Inferring, and Predicting) of science process skills.
2. Mean scores of communicating skill is higher than the other dimension of science process skills.
3. Based on Gender the male and female students differ significantly in their science process skills (Observing skill). There is no significant difference found in the rest of science process skills (Measuring, Classifying, Inferring, Predicting and Communicating).
4. Based on Locality the urban and rural students differ significantly in their science process skills (Measuring skill). There is no significant difference found in the rest of science process skills (Observing, Classifying, Inferring, Predicting and Communicating).
5. Based on the Medium of Instruction the Tamil and English Medium students differ significantly in their science process skills (Inferring and Communicating skills). There is no

significant difference found in the rest of science process skills (Observing, Measuring, Classifying, and Predicting).

6. Based on Type of Management the students differ in the dimension of classifying, communicating, inferring and total science process skills. Since the combinations of govt. and aided groups are highly significant than other combination groups. But other skills of science process skills with respect to type of school management, there is no significance different.

7. There is a very low positive correlation between science process skills and achievement in science of high school students.

Educational Implications

1. Science teachers should contribute to narrowing the gap between class room science and its application to daily life by emphasizing the contributions that laboratory activities could make in raising the learners' various intellectual and procedural skill that are likely to be useful in their future careers.

2. Through constant motivation and encouragement during the teaching-learning activities in science the students can re-conceptualize their perceptions about science learning and they will be more involved in the activities.

3. Innovative and creative instructional styles may aid in facilitating a fun filled and enjoyable science environment.

Conclusion: Processes of science are the basic steps for the development of useful skills, right kind of interests, attitudes and values and in making teaching –learning process more dynamic, stimulating and meaningful. Since High school level is a period in which students will start thinking about their subject preferences and their future career, this study is of much use to suggest ways and means to develop the critical thinking skills and interest in science among the high school students.

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