Emerging Trends in Education [ Vol. XI - No. 1 & 2. Feb. & August, 2024 . pp 01-05 ]

# SCIENCE PROCESSES AND LEARNING ENVIRONMENT AS PREDICTORS OF ACHIEVEMENT IN SCIENCE

***Karuna Shankar Misra****

## Abstract

Science education is very essential at the middle school stage. Providing a conducive learning environment for the learning of science and science processes can influence students' achievement in science, the present study attempts to find out whether these variables can predict achievement in science. Sample consisted of 209 students of class VIII studying in Prayagraj. 'Test of science Process' and 'Learning Environments Inventory' constructed by the researcher and 'Science Achievement Test' constructed by Kalplata Pandey were used to collect the data. Analysis of the data was done by using step wise regression analysis. Findings revealed that science processes and four dimensions of learning environment namely- Competition, Favouritism, Creative stimulation and Diversity can predict variance in scores on....

## Introduction

Science education in our country remains primarily didactic dominated by textbook reading, lecture, demonstration and thrust on memorization. Students usually perceive their teachers as knowledge-stores. Demonstrations by science teachers in laboratories or classrooms serve as models to be imitated as shown by teachers. Students try their level best to mimic them as accurately as possible. Practical notebooks of previous students help in writing the procedure followed and discussions of findings. Innovative practices to develop information processing abilities in science are seldom used by teachers. Traditional approaches to teaching science have been ineffective for fostering conceptual understanding in science. It is essential that students become competent in science process skills/abilities and experience the ethos of learning science. 'Science for all' is the target towards which educators must move. Irwanto, Rohaeti and Prodjosantoso (2019) stated that scientific process skills increase students' ability to absorb scientific knowledge; and develop critical thinking, decision making, and problem-solving skills. NEP (2020) has emphasized inquiry based, experiential and discovery-based learning. This can facilitate students' later placement in high level science courses. It seems that science processes and learning environment in science classrooms can influence students' achievement in science. The present study attempts to find out whether science processes and learning environment can predict students' achievement in science.

## Review of Related Studies

Fredrick (2008) reported that gender has not much influence on the science

* Former Vice-Chancellor, University of Allahabad, Prayagraj

process skills acquisition on the students. Aktamis and Ergin (2008) and Turpin (2000) concluded that students' academic achievement increased because of the activities carried out to develop scientific process skills in the science course. A positive relationship was observed by Feyzioğlu (2009), Harlen (1999), Jackson (2000), Koray, Köksal, Saat (2004), Sittirug (1997), and Unutkan (2006). Findings of Amaefuna (2013) revealed that students taught using science process skills methods performed better than their peers.

Riffat, Ghazala and Anjum (2011) conducted the study of relationship among Science Process Skills Acquisition, Achievement Motivation and Academic Achievement in English and Mathematics in Secondary school level. found that Science Process Skills Acquisition, Achievement Motivation and Academic Achievement are significantly related to the academic achievement.

Ahuja (2019) used a sample of 336 class IX students of three Government senior secondary school in Delhi for data collection through Misra's Test of Science Processes and Mid-term examination marks. It showed that there were gender differences in the favour of boys with respect to science process skills as well as academic achievement scores and science process skills and academic achievement were positively corelated to each other.

Ogbogu and Osuafor (2021) studied the relationship between students' level of science process skill acquisition and their academic achievement in biology among 6,400 senior secondary school students and found a significant positive relationship between the two variables.

The main purpose of the study done by Dolapcioglu and Subasi (2022) was to bring together the quantitative findings obtained on the relationship between scientific process skills and academic achievement in science education. 234 articles published between 2005 and 2020 were obtained. Following the application of the inclusion criteria, 18 articles were selected according to the random-effects model, resulting in an average effect size of 0.56. It was determined that there is a moderate and positive relationship between scientific process skills and academic achievement. As the use of scientific process skills increases, their academic success also increases.

## Objectives of the study

The objective of the study is to find out whether 'Science process and learning environment contribute to prediction of variance in science achievement.'

## Research Hypothesesis

It was hypothesized that 'Science process and various dimensions of learning environment predict achievement in science'.

## Procedure of the Study

**Sample:** Sample consists of 209 students of class VIII studying in Prayagraj.

**Tools used:** 'Test of Science Processes' constructed by the researcher and

'Science Achievement Test' constructed by Kalplata Pandey were used to collect the data. Self-constructed Learning Environments Inventory was used to measure eighteen dimensions of teacher-student interaction in the classroom namely- cohesiveness, diversity, formality, speed, facilitation, friction, goal direction, favouritism, difficulty, apathy, democratic orientation, cliqueness, disorganization, competition, creative stimulation, encouragement, involvement and conformity.

**STATISTICAL TECHNIQUES USED:** Analysis of the data was done by using step wise regression analysis.

## Results and Discussion

**Table-1** Multiple correlations and 'B' showing predictors of achievement in science

| Step No. | Variable | R | R-square | F for R | B |
|---|---|---|---|---|---|
| 1 | Science processes | .2736 | .0749 | 16.7303** | .4460 |
| 2 | Competition | .3524 | .1242 | 14.6016** | .6391 |
| 3 | Favouritism | .4122 | .1699 | 13.9893** | -.4675 |
| 4 | Creative stimulation | .4352 | .1894 | 11.9192** | -.4226 |
| 5 | Diversity | .4628 | .2142 | 11.0663** | .4612 |

At the fifth step science processes and four dimensions of learning environment namely- competition, favouritism, creative stimulation, and diversity emerged as the best predictors of achievement in science. They together contributed to 21.42 per cent of variance in achievement in science. The values of R-square changes for science processes, competition, favouritism, creative stimulation, and diversity were .2736, .0493, .0457, .0195, and .0248 respectively. So, the percentage of variance contributed by science processes, competition, favouritism, creative stimulation, and diversity were 7.49, 4.93, 4.57, 1.95, and 2.48 respectively. 'B' values point to facilitative effect of science processes, competition and diversity and inhibiting effects of favouritism and creative stimulation.

It has been found that science processes contribute to prediction of 7.49 percent of variance in achievement. This draws support from the findings of Sittirug (1997), Harlen (1999), Jackson (2000), Saat (2004), Unutkan (2006), Koray, Köksal and Presley (2007), and Feyzioğlu (2009), Riffat, Ghazala and Anjum (2011), Ahuja (2019) and Ogbogu and Osuafor (2021) whose results revealed existence of a

positive relationship between science process skills and science achievement. Amaefuna's (2013) study has also revealed that students taught using science process skills methods performed better than their peers. Aktamis and Ergin (2008) and Turpin (2000) concluded that students' academic achievement increased because of the activities carried out to develop scientific process skills in the science course.

When science teachers lay emphasis on the teaching of science processes, a learning environment conducive to learning of scientific knowledge and conceptual understanding is created in the classroom and this can help students to achieve more. Findings of the present study indicate facilitative effect of science processes, competition and diversity and inhibiting effects of favouritism and creative stimulation. It has been found that 4.93, 4.57, 1.95, and 2.48 percent of variance can be contributed by competition, favouritism, creative stimulation, and diversity respectively.

## References


- Ahuja, A. (2019). Study of Science Process Skills and Academic Achievement among Secondary School Students. International Journal of Advanced Networking and Applications, 343-346.
- Aktamis, H. & Ergin, Ö. (2008, June). The effect of scientific process skills education on students' scientific creativity, science attitudes and academic achievements. In Asia-Pacific Forum on Science Learning and Teaching, 9 (1) , 1-21.
- Amaefuna, I.A. (2013). Effects of Constructivist-based instructional model on students' achievement in biology and critical thinking skills. Unpublished M.Ed Thesis, Nnamdi Azikiwe University Awka, Nigeria.
- Dolapcioglu, S. & Subasi, M. (2022) : The relationship between scientific process skills and science achievement : A meta-analysis study. Journal of Science Learning, 5(2) 363-372.
- Feyzioğlu, B. (2009). An investigation of the relationship between science process skills with efficient laboratory use and science achievement in chemistry education. Journal of Turkish science education, 6(3), 114-132.
- Fredericks, J. A. (2008). Student's Engagement; Potential of concept, state of the Evidence. Review of Educational Research, 74(1), 59-109.
- Harlen, W. (1999). Purposes and procedures for assessing science process skills. Assessment in Education: Principles, Policy & Practice, 6(1), 129-144. https://doi.org/10.1080/09695949993044
- Irwanto, I., Rohaeti, E., & Prodjosantoso, A. K. (2019). Analyzing the relationships between preservice chemistry teachers' science process skills and critical thinking skills. Journal of Turkish Science Education, 16(3), 299-313.

- Irwanto, R., & Prodjosantoso, A. K. (2018). Undergraduate students' science process skills in terms of some variables: a perspective from Indonesia. Journal of Baltic Science Education, 17(5), 751.
- Jackson, L. (2000). Increasing critical thinking skills to improve problem-solving ability in mathematics. Retrieved from https://files.eric.ed.gov/fulltext/ED446995.pdf
- Koray, Ö., Köksal, M. S., Özdemir, M., & Presley, A. İ. (2007). The effect of creative and critical thinking based laboratory applications on academic achievement and science process skills. Elementary Education Online, 6(3). http://ilkogretim-online.org.tr/index.php/io/article/viewFile/1892/1728
- Ogbogu, E. & Osuafor, A. M. (2021). Relationship between students' science process skills acquisition scores and academic achievement in biology in Anambra State. IOSR Journal of Research & Method in Education, www.iosrjournals.org, DOI: 10.9790/7388-1103053440 www.iosrjournals.org
- Özdemir, M. (2004). Fen eğitiminde bilimsel süreç becerilerine dayalı laboratuar yönteminin akademik başarı, tutum ve kalıcılığa etkisi [The effects of cooperative learning based on constructivist approach in primary social studies] (Unpublisahed master's thesis). Zonguldak , Turkey: Zonguldak Karaelmas University.
- Riffat, U.N.A., Ghazala, N. & Anjum, N. (2011). A study of relationship between achievement motivation and achievement in English and Mathematics at secondary level. International Education Studies, 4(3), 72-81.
- Saat, R. M. (2004). The acquisition of integrated science process skills in a web- based learning environment. Research in Science & Technological Education, 22(1), 23-40.
- Sittirug, H. (1997). The predictive value of science process skills, attitude toward science, and cognitive development on achievement in a Thai teacher institution. Unpublished PhD Thesis, University of Missouri-Columbia.
- Turpin, T. J. (2000). A study of the effects of an integrated, activity-based science curriculum on student achievement, science process skills, and science attitudes, upon the science process skills of urban elementary students. Journal of Education, 37(2).
- Unutkan, O. P. (2006). A study of pre-school children's school readiness related to scientific thinking skills. Turkish Online Journal of Distance Education, 7(4), 78-85. https://dergipark.org.tr/en/pub/tojde/issue/16926/176679